SCIENTIFIC AMERICAN

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VICTOR BICYCLES.

It is a well established fact that manufacturing cannot be carried on successfully in these days of high pressure without the utmost regard for system, not only in carrying forward the actual process of manufacture, but also in the construction and arrangement of the plant by which the work is accomplished, so that every motion of the mechanic or the machine counts in the production of the finished article, and no energy is uselessly expended. In fact, a modern manufactory is nothing but a huge machine, consisting partly of iron and steel and partly of brain and muscle, into which are poured the materials, and out of which are taken the finished products without a single retrograde movement in the progress of the article toward completion.

Such works as these are ideal, but we have them; they belong to our country and our time. We know of no finer example of such works than the factory of the Overman Wheel Company, of Chicopee Falls, Mass., the manufacturers of the Victor bicycles, everywhere well known for elegance of design and excellence of material and workmanship. Before proceeding to describe the works in which these machines are made, it is, perhaps, well to revert to the machine itself.

Several varieties of bicycles are made at this establishment, but we have selected one as a type, which is known as model "C." This machine is of the kind now commonly known as the "Safety," both wheels being of approximately the same diameter. The machine has a very rigid frame of diamond shape; the rear or driving wheel is furnished with what is known as the Victor cushion tire, which is shown in section in one of the smaller engravings. This tire is a simple arch of rubber extending from edge to edge of the rim. Its side walls are held

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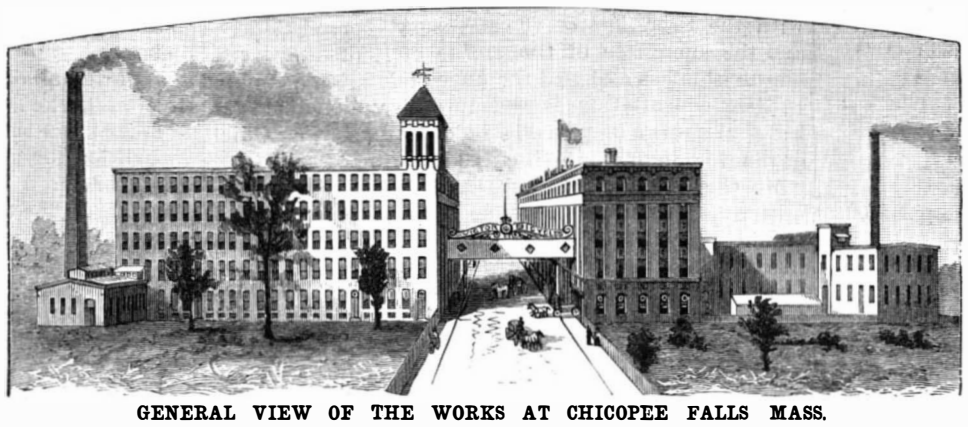
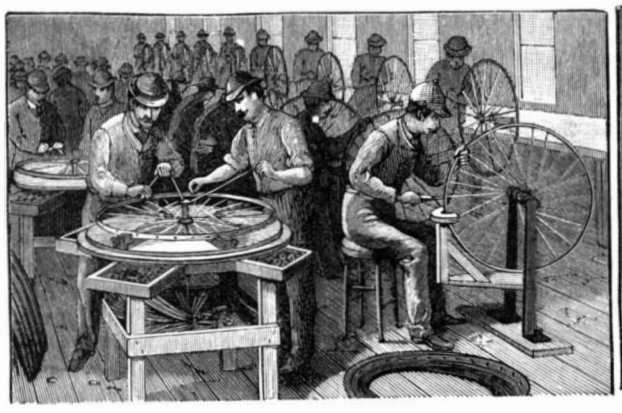


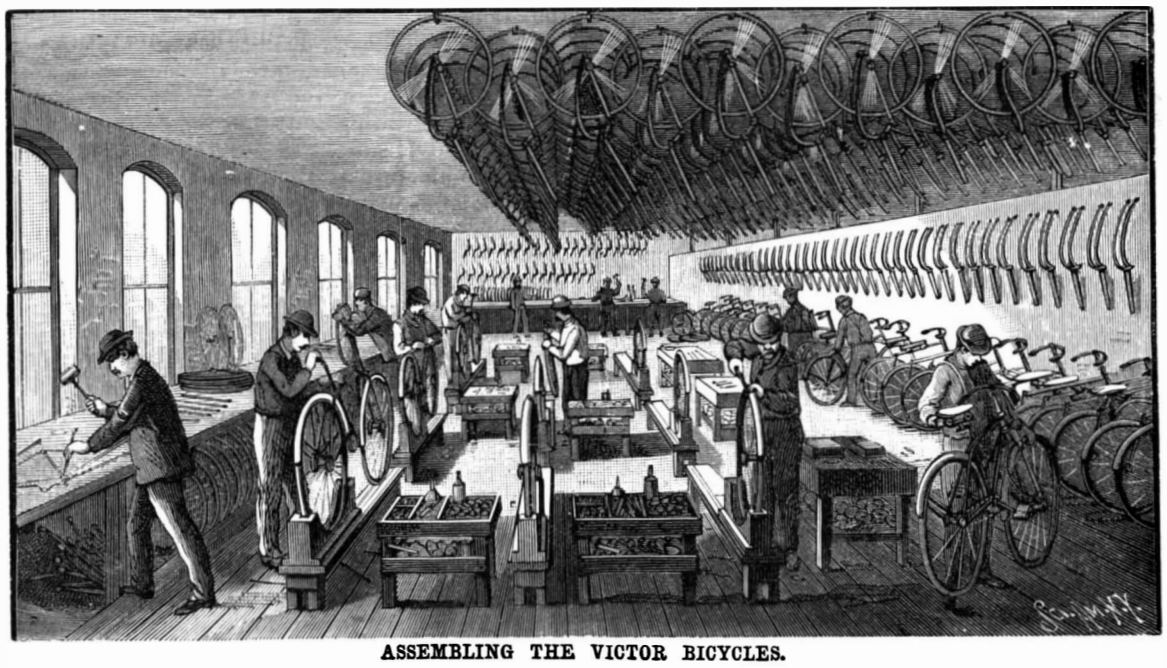
GENERAL VIEW OF THE WORKS AT CHICOPEE FALLS MASS.



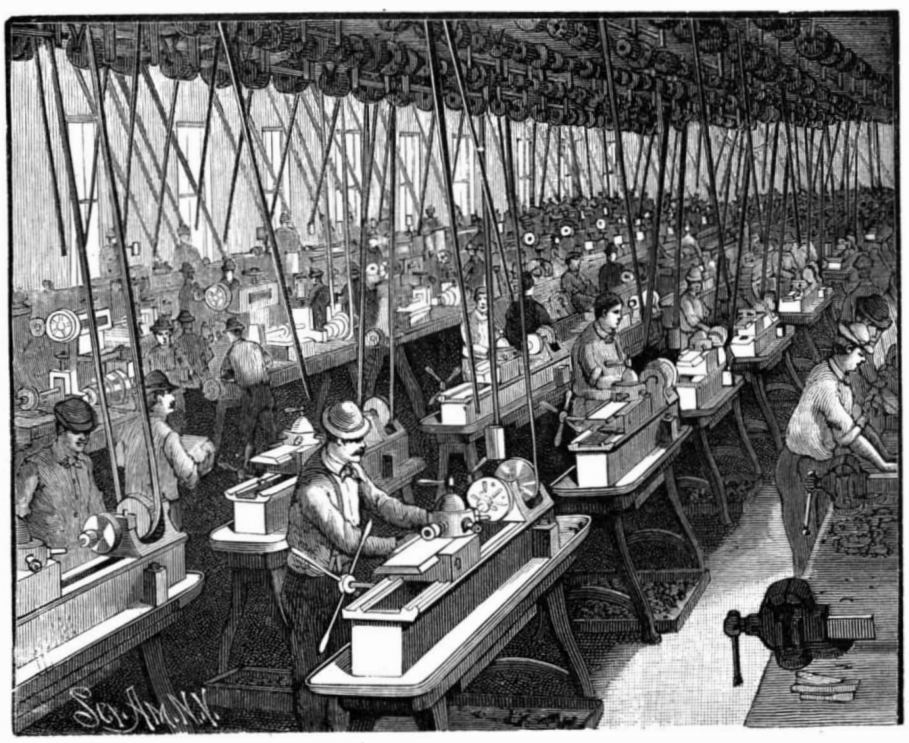
WHEEL MAKING.

IN THE NICKEL PLATING ROOM.

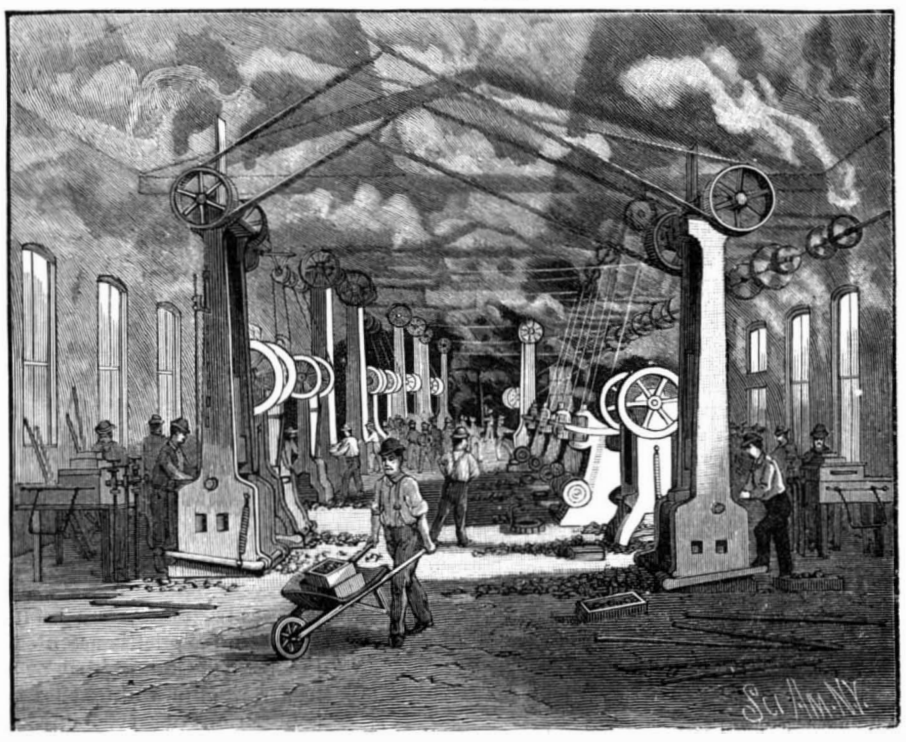
PRESIDENT'S PRIVATE OFFICE.



ASSEMBLING THE VICTOR BICYCLES.



SCREW MACHINE ROOM.



DROP FORGING SHOP.

THE MANUFACTURE OF BICYCLES—WORKS OF THE OVERMAN WHEEL CO.

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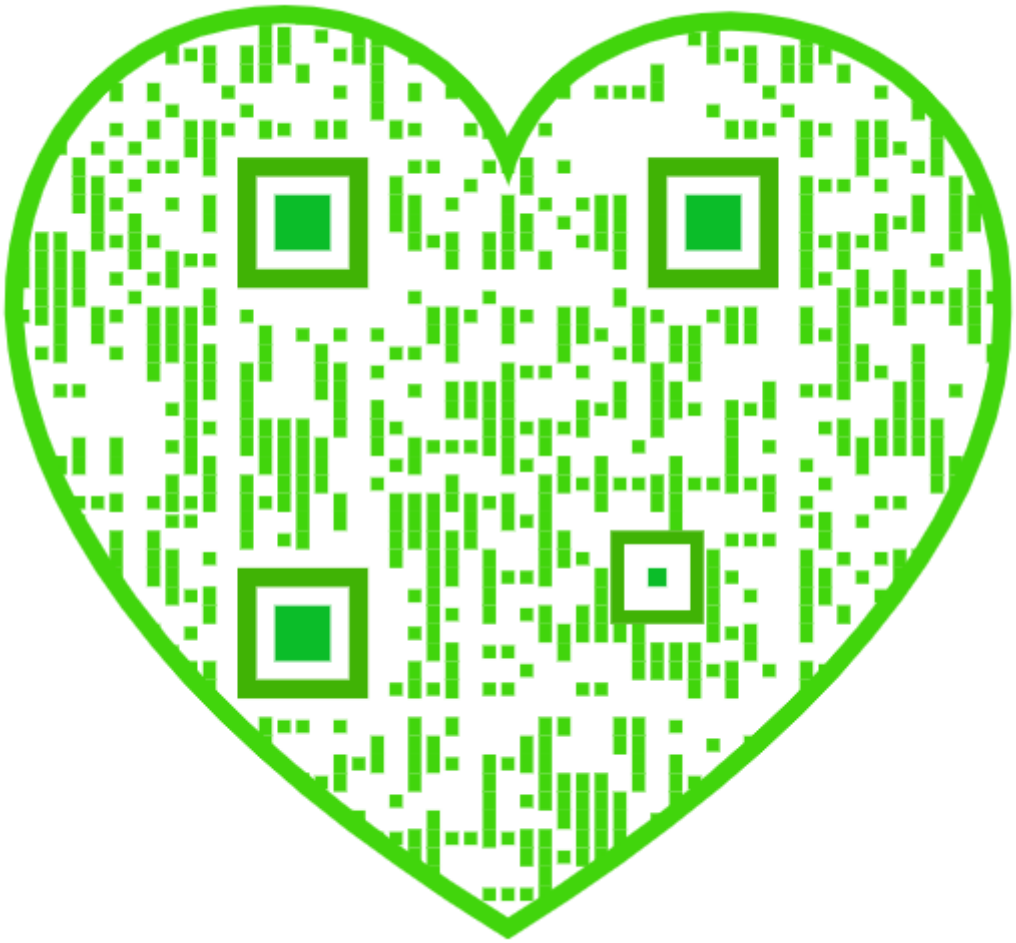

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RIGHTS OF EMPLOYERS TO INVENTIONS MADE BY THEIR EMPLOYES.

An interesting patent case was decided not long ago by the Supreme Court of the United States in which the rights of employers with respect to inventions made by their employes, at the expense and in the time of the employer, are set forth. This was a suit brought by Solomons, assignee of Clark, against the United States, to recover damages for the use of a self-canceling revenue stamp, invented and patented by Clark.

It appears that during the years 1867 and 1868, Spencer M. Clark was in the employ of the government as Chief of the Bureau of Engraving and Printing. While so employed he was called officially into consultation with the Secretary of the Treasury, commissioners, and the committee of the House of Representatives, and to him was assigned the duty of devising a stamp. In these consultations it was mutually understood that Mr. Clark was acting in his official capacity, as Chief of the Bureau of Engraving and Printing.

Mr. Clark laid before the Commissioner and committee a self-canceling revenue stamp, as being, in his opinion, a very desirable stamp for the prevention of fraud. This stamp was satisfactory to the Committee on Ways and Means and to the Commissioner of Internal Revenue.

No bargain, agreement, contract, or understanding was ever entered into or reached between the officers of the government and Mr. Clark concerning the right of the government to use the invention, or concerning the remuneration, if any, which should be paid for it. Neither did Mr. Clark give notice or intimate that he intended to protect the same by letters patent, or that he would expect to be paid a royalty if the government should manufacture and use stamps of his invention. Before the final adoption of the stamp by the Commissioner of Internal Revenue, he stated to him that the design was his own, but that he should make no charge to the government therefor, as he was employed on a salary by the government, and had used the machinery and other property of the government in the perfection of the stamp. No express license to use the invention was ever given by Mr. Clark to the government, nor any notice prohibiting its use, or intimating that he would demand a royalty.

Before Mr. Clark had filed an application for a patent, the Commissioner of Internal Revenue adopted the stamp as the one to be used in the collection of the tax on whisky and distilled spirits. It was adopted by the Commissioner on the recommendation of Mr. Clark, and engraved and made in the Bureau of Engraving and Printing and approved by the Committee of Ways and Means. The government then proceeded to manufacture at the Bureau of Engraving and Printing large quantities of these stamps. On Dec. 21, 1869, a patent was granted to Solomon, as assignee of Clark, for the invention.

In the Court of Claims judgment was entered in favor of the government. From such judgment an appeal was brought to the Supreme Court.

Mr. Justice Brewer delivered the opinion of the Court, from which we abstract the following:

The government has used the invention of Mr. Clark, and has profited by such use. It was an invention of value. The claimant and appellant is the owner of such patent, and has never consented to its use by the government. From these facts, standing alone, an obligation on the part of the government to pay naturally arises. The government has no more power to appropriate a man's property invested in a patent than it has to take his property invested in real estate; nor does the mere fact that an inventor is, at the time of his invention, in the employ of the government transfer to it any title to or interest therein. An employe, performing all the duties assigned to him in his department of service, may exercise his inventive faculties in any direction he chooses, with the assurance that whatever invention he may thus conceive and perfect is his individual property. There is no difference between the government and any other employer in this respect. But this general rule is subject to these limitations:

If one is employed to devise or perfect an instrument, or a means for accomplishing a prescribed result, he cannot, after successfully accomplishing the work for which he was employed, plead title thereto as against his employer. That which he has been employed and paid to accomplish becomes, when accomplished, the property of his employer. Whatever rights as an individual he may have had in and to his inventive powers, and that which they are able to accomplish, he has sold in advance to his employer.

So, also, when one is in the employ of another in a certain line of work, and devises an improved method or instrument for doing that work, and uses the property of his employer and the services of other employes to develop and put in practicable form his invention, and explicitly assents to the use by his employer of such invention, a jury, or a court, trying the facts, is warranted in finding that he has so far recognized the obligations of service flowing from his employment and the benefits resulting from his use of the property, and the assistance of the co-employes, of his employer, as to have given to such employer an irrevocable license to use such invention.

The case of *McClurg v. Kingsland* (1 How., 202) is in point. In that case was presented the question as to the right of the defendants to use an invention made and patented by one Harley. The facts as stated and the rulings of the court are these:

That Harley was employed by the defendants at their foundry in Pittsburg, receiving wages from them by the week. While so employed, he claimed to have invented the improvement patented, and, after several unsuccessful experiments, made a successful one in October, 1834. The experiments were made in the defendants' foundry, and wholly at their expense, while Harley was receiving his wages, which were increased on account of the useful result. Harley continued in their employment on wages until January or February, 1835, during all of which time he made rollers for them. He often spoke about procuring a patent, and prepared more than one set of papers for the purpose; made his application the 17th February, 1835, for a patent. It was granted on the 3d of March, and assigned to the plaintiffs on the 16th of March, pursuant to an agreement made in January. While Harley continued in the defendants' employment, he proposed that they should take out a patent, and purchase his right, which they declined. He made no demand on them for any compensation for using his improvement, nor gave them any notice not to use it, till, on some misunderstanding on another subject, he gave them such notice, about the time of his leaving their foundry, and after making the agreement with the plaintiffs, who owned a foundry in Pittsburg, for an assignment to them of his right. The defendants continuing to make rollers on Harley's plan, the present action was brought in October, 1835, without any previous notice by them. The court left it to the jury to decide what the facts of the case were, but, if they were as testified, charged that they would fully justify the presumption of license, a special privilege, or grant to the defendants to use the invention; and the facts amounted to "a consent and allowance of such use," and show such a consideration as would support an express license or grant, or call for the presumption of one to meet the justice of the case, by exempting them from liability, having equal effect with a license, and giving the defendants a right to the continued use of the invention.

On review in this court, the rulings of the trial court were sustained. That case is decisive of this. Clark was in the employ of the government when he made this invention. His experiments were wholly at the expense of the government. He was consulted as to the proper stamp to be used, and it was adopted on his recommendation. He notified the government that he would make no charge if it adopted his recommendation, and used his stamp; and for the express reason that he was in the government employ, and had used the government machinery in perfecting his stamp. He never pretended, personally, to make any charge against the government. Indeed, there is but one difference between that case and this. In that Harley's wages were increased on account of his invention; in this, Clark's were not; but such difference does not seem vital. We think, therefore, the rulings of the Court of Claims were correct, and its judgment is affirmed.

POSITION OF THE PLANETS IN MAY.

MERCURY

is evening star until the 9th, and then morning star. He is in inferior conjunction with the sun on the 9th, at 9 h. 41 m. P. M. The event is of unusual importance, for, as he passes between the earth and the sun, he makes a transit on the sun's disk, and will be visible upon it as a small black spot, a phenomenon that has not occurred for nearly ten years. The transit commences at 6 h. 54 m. P. M. and ends at 11 h. 50 m. P. M. in Eastern standard time, the transit continuing 4 h. 56 m. It will not be visible in New York, for it begins about sunset, but the farther west and north the observer is, the better will be the opportunity for witnessing it. For those who use central time, the transit commences at 5 h. 54 m. P. M., and is visible for an hour, or until sunset. For those who use Pacific time, the transit commences at 3 h. 54 m. P. M., and is visible for three hours, or until sunset. The whole western coast of North and South America furnishes a favorable locality for observing the transit. Every 15° of longitude makes an hour's difference in time. Traveling westward, it is so much earlier; traveling eastward, it is so much later.

As soon as it was discovered that Mercury was an inferior planet, revolving within the earth's orbit, it was known that he must pass between the sun and the earth at every inferior conjunction. If his orbit lay in the same plane as the earth's, there would be a transit at every revolution. His orbit is, however, inclined 7° to the earth's, and he must be at his nodes or crossing points, or else he will pass above or below the sun, and there will be no transit. The earth arrives at Mercury's nodes on May 7 and November 9, and transits must occur near those dates.

It is easy to calculate the recurrence of transits.

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Twenty-two syndodic periods of Mercury are nearly equal to 7 years, 41 more nearly equal to 13 years, and 145 almost exactly equal to 46 years. After a November transit, therefore, one is possible in 7 years, probable in 13 years, and almost certain in 46 years. The May transits are less numerous, on account of the planet's different position in regard to the earth. The repetition cannot occur after 7 years, and is by no means sure after 13 years. The nineteenth century includes 13 transits, 4 May transits and 9 November transits, that of November 10, 1894, completing the record.

As Mercury is too small to be visible to the naked eye when crossing the sun, a transit was not observed until years after the invention of the telescope, Gassendi being the first to witness the phenomenon in 1631.

Transits of Mercury have little practical importance. They give data for measuring the planet's diameter, and for accurate determination of his orbit. Those, however, who have access to telescopes, and are in the right locality, will find the observation of the smallest member of the solar brotherhood, as he makes his way, like a tiny black ball, over the face of the mighty sun, an event as impressive as it is curious and interesting.

The right ascension of Mercury on the 1st is 3 h. 20 m., his declination is 20° 25′ north, his diameter is 10″.8, and he is in the constellation Aries.

Mercury sets on the 1st at 7 h. 55 m. P. M. On the 31st he rises at 3 h. 33 m. A. M.

JUPITER

is morning star. He has parted from Venus, and is making his way westward from the sun, and while approaching the earth is increasing in size and brilliancy. He rises on the middle of the month about three hours before the sun, and is wonderfuliy beautiful, as he shines on the dark background of the sky in the small hours of the morning.

The moon, two days after her last quarter, is in conjunction with Jupiter, on the 3d, at 9 h. 57 m. A. M., being 4° 36′ south.

The right ascension of Jupiter on the 1st is 22 h. 53 m., his declination is 8° 8′ south, his diameter is 34″.6, and he is in the constellation Aquarius.

Jupiter rises on the 1st at 2 h. 38 m. A.M. On the 31st he rises at 0 h. 52 m. A. M.

SATURN

is evening star. He is on the meridian on the 1st at 8 h. 12 m. P. M. Observers who follow his course carefully will notice a change after the 12th. He no longer approaches Regulus, but commences to move eastward, or in direct motion, as it is called, and continues to move in this direction until the close of the year. All who have access to telescopes should improve the opportunity for beholding the planet deprived of his rings.

The moon, the day after the first quarter, is in conjunction with Saturn, on the 16th, at 7 h. 5 m. P. M., being 3° 27′ north.

The right ascension of Saturn on the 1st is 10 h. 51 m., his declination is 9° 37′ north, his diameter is 17″.8, and he is in the constellation Leo.

Saturn sets on the 1st at 2 h. 43 m. A. M. On the 31st he sets at 0 h. 48 m. A. M.

NEPTUNE

is evening star until the 27th, and then morning star. He is in conjunction with the sun on the 27th at 11 h. P. M., and is then out of the reach of the most powerful telescopes, for he is not only hidden in the sun's rays, but is at his greatest distance from the earth.

The right ascension of Neptune on the 1st is 4 h. 16 m., his declination is 19° 42′ north, his diameter is 2″.5, and he is in the constellation Taurus.

Neptune sets on the 1st at 8 h. 47 m. P. M. On the 31st he rises at 4 h. 23 m. A. M.

VENUS

is morning star. There is nothing eventful in her course during the month as she slowly travels toward the sun. She was indeed the queen of the stars, when last month, near conjunction, she appeared side by side with Jupiter in the golden glory of the dawn, but she rises now only an hour and a quarter before the sun, and it will soon be hard to find her amid the brightness of the solar rays.

The moon, three days before her change, is in conjunction with Venus on the 5th, at 8 h. 41 m. A. M., being 2° 54′ south.

The right ascension of Venus on the 1st is 0 h. 25 m., her declination is 0° 55′ north, her diameter is 13″.8, and she is in the constellation Pisces.

Venus rises on the 1st at 3 h. 37 m. A. M. On the 31st she rises at 3 h. 7 m. A. M.

MARS

is evening star. The event of interest in his course is his very close conjunction with the moon on the 9th at 10 h. 45 m. P. M., when he is only 1′ north of the moon, an almost inappreciable distance. The two days' old crescent and the tiny red planet, almost touching it on the north, would be a most interesting phenomenon, but at the time of its occurrence moon and planet are below the horizon, and the celestial picture can be seen only in the mind's eye.

The right ascension of Mars on the 1st is 4 h. 23 m., his declination is 22° 19′ north, his diameter is 4″.2, and he is in the constellation Taurus.

Mars sets on the 1st at 9 h. 6 m. P. M. On the 31st he sets at 8 h. 44 m. P. M.

URANUS

is evening star. His right ascension on the 1st is 13 h. 48 m., his declination is 10° 33′ south, his diameter is 3″.8, and he is in the constellation Virgo.

Uranus sets on the 1st at 4 h. 28 m. A. M. On the 31st he sets at 2 h. 28 m. A. M.

Venus, Mercury, Neptune, and Jupiter are morning stars at the close of the month. Mars, Saturn, and Uranus are evening stars.

Beauty as a Means of Health.

Before one of the New York working girls' clubs, Dr. Louise Fiske Bryson recently gave an address upon this subject, reversing in more ways than one the usual order of copybook aphorism. While acknowledging the impossibility of any protracted happiness without virtue, and the maintenance of beauty's fine edge without goodness, the doctor affirmed that systematic efforts to be beautiful will insure a fair degree of health, and that happiness is the best safeguard against vice. The difference in appearance between one woman and another, it was stated, is more than anything else an affair of style—that beauty of beauties so hard to define and so easy to recognize, which makes the girl of no-colored hair, features of indifferent turn, and lines none too perfect, infinitely more attractive than other maids of faultless curves and innumerable strong points not cemented by this magic quality. Style may be defined, for want of something better to express it, as an attractive manner of holding the body, a firm, graceful way of doing things and of moving about. It is the visible sign of inherent power and reserve force. It is the outcome of long, deep breaths and the use of many muscles. The prayer of the New York child, "Lord, make us very stylish," when viewed aright, is recognized as an aspiration based upon sound scientific principles and worthy of universal commendation.

Proper breathing is the first art to cultivate in the pursuit of beauty. The lungs have their own muscular power, and this should be exercised. The chest must be enlarged by full, deep breathing, and not by muscular action from without. Inflate the lungs upward and outward, as if the inflation were about to lift the body off the ground. Hold the shoulders on a line with the hips, and stand so that the lips, chin, chest, and toes come upon one line, the feet being turned out at an angle of sixty degrees. It is wrong to make the bony structure do most of the work in keeping the body upright. The muscles should hold it in position. In walking, keep face and chest well over the advanced foot, and cultivate a free, firm, easy gait, without hard or jarring movements. It is impossible to stand or breathe aright if the feet are pinched. When correct posture and breathing are interfered with, the circulation is impeded, and deleterious substances in the blood tend to make the complexion bad. This is one of the many evils of tight shoes. To be well shod has a marked influence on style. The feet symbolize the body in their way as much as the hands. A clever shoemaker says that in a well-fitting shoe the human foot feels like a duck's foot in the mud. It is held firmly in place, but nowhere compressed. Nothing can exceed the vulgarity and hygienic wickedness of a shoe that is manifestly too tight. For misery-producing power, hygienically as well as spiritually speaking, perhaps tight boots are without a rival. Next to the search for style pure and simple as a means of health, the care of the complexion and the cultivation of the right kind of expression are of great importance. The first is largely a matter of bathing and the general hygiene of the skin, while the second—a good expression—is best secured by the constant preference of higher thoughts over lower ones. This is the essence of intellectual living, and is fortunately within reach of us all.

Beauty that is lasting and really worth while is more or less dependent upon a good circulation; while a good circulation is made possible by correct pose, proper breathing, and the judicious care of the skin, something else is also necessary to insure the normal quality and activity of the blood. And this something consists in a combination of sunshine and exercise in the open air. Town dwellers have too little of these blessings, partly from circumstances and partly from lack of wit. Exercise is the most important natural tonic of the body. Without it there can be no large, compact, muscular frame. It is as essential to physical development as air is to life, and an imperative necessity in the maintenance of beauty. To keep the complexion and spirits good, to preserve grace, strength, and ability of motion, there is no gymnasium so valuable as the daily round of housework, no exercises more beneficent in their results than sweeping, dusting, making beds, washing dishes, and the polishing of brass and silver. One year of such muscular effort within doors, together with regular exercise in the open air, will do more for a woman's complexion than all the lotions and pomades that ever were invented. Perhaps the reason why housework does so much more for women than games is the fact that exercise which is immediately productive cheers the spirit. It gives women the courage to go on with living, and makes things seem really worth while.

In a general way the great secrets of beauty, and therefore of health, may be summed up as follows: Moderation in eating and drinking; short hours of labor and study; regularity in exercise, relaxation, and rest; cleanliness; equanimity of temper, and equality of temperature. To be as good looking as possible, and to be physically well, one must in general be happy. And to be happy, it is necessary to carry out ideas of personal taste and preference, as many of them as can be put into definite form without infringing upon the rights of others. Happiness has a distinct æsthetic and hygienic value. In itself it will secure perfect poise and respiration. To be happy is a duty just as style is a duty, and both are in great measure an affair of intellect and management. The old order put the cart before the horse; it said: "Be virtuous and you will be happy," a rule with many exceptions. But the old order changeth. And the modern gospel postulates happiness and material prosperity as the basis of morality. Other times, other manners. The ardent pursuit of good looks sums up the best there is in hygiene, and becomes a legitimate and praiseworthy means of health. The world has yet room for two or three truths, of which not the least is the fact that the definite desire for personal beauty—which was in the beginning, is now, and ever shall be—constitutes in itself a perfectly proper and meritorious inspiration to effort, especially in a country where the shades of Puritanism linger as a sad inheritance, and where disinterred Buddhism claims too often the frail neurasthenic for its own.—*Medical Record.*

DECISIONS RELATING TO PATENTS.

ASSIGNMENTS, LICENSES, MORTGAGES OF PATENTS.

Supreme Court of the United States.

WATERMAN *vs.* MACKENZIE *et al.*

An assignment is an instrument in writing, conveying either (1) the whole patent, comprising the exclusive right to make, use, and vend the invention throughout the United States; or (2) an undivided part or share of that exclusive right; or (3) the exclusive right under the patent within and throughout a specified part of the United States.

Such an instrument vests in the assignee a title in so much of the patent itself, with a right to sue infringers, alone in the first and third cases, and jointly with the assignor in the second.

Any other transfer is a mere license, giving the licensee no title in the patent and no right to sue at law in his own name for an infringement.

A grant, by the owner of a patent, of the sole and exclusive right and license to manufacture and sell the patented article throughout the United States, does not include the right to use such patented article, at least if manufactured by third persons, and is, therefore, a mere license.

The recording of a mortgage of a patent right in the Patent Office is equivalent to a delivery of possession and makes the title of the mortgagee complete toward all other persons, as well as against the mortgagor; and the mortgagee is the only person who can thereafter sue for an infringement of the patent by third persons.

Mr. Justice Gray delivered the opinion of the court.

To Remove Tattooing.

Mr. T. W. Dodd, of Walsingham, England, writes as follows in the *Chemist and Druggist:*

"Twenty years ago I removed three very indelible tattoo marks on my hand. Certainly it left a scar, but now it is scarcely perceptible. The operation was performed by applying nitric acid with the stopper of the bottle (a better instrument would be a glass rod pointed, to carry the acid), just sufficient to cover the stain, so as to avoid making a larger scar than needful, the acid to remain about one and a half minutes, until the *cutis vera* was penetrated and a crusted appearance shown, then washed off with clean cold water. In a few days after this treatment a scab forms, which contains the tattoo mark or stain; remove it, and should inflammation supervene, poultice and bathe with warm water. In this way the skin with the stain is not only removed almost painlessly (I mean tattoo marks about the size of peas), but the nitric acid at the same time to a certain extent seems to decolorize the stain. Of course large tattoo marks, greatly extending over the surface, must necessitate the operation being performed differently.

Dr. Variot, of the Paris Biological Society, advises the following method: Tattoo the skin, in the usual way, with a concentrated solution of tannin, following the original design. Then apply a crayon of nitrate of silver until the part tattooed with the tannin blackens. Wipe off excess of moisture and allow matters to take their own course. Slight pain continues for two to four days, and after two months the cicatrix which results will almost disappear.—*Amer. Druggist.*

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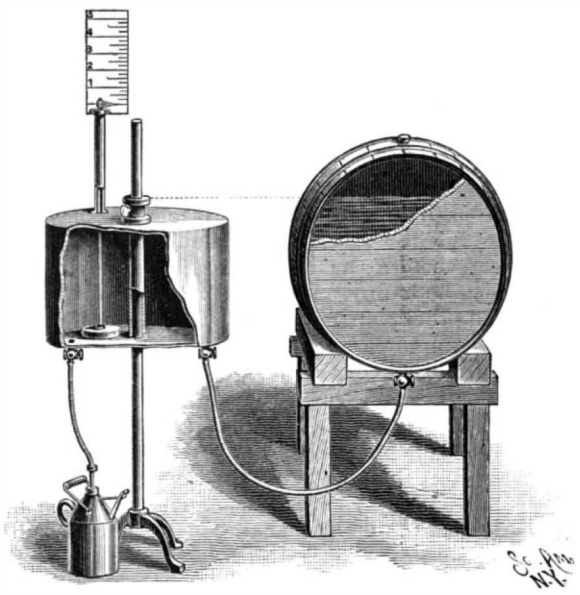
PROCTOR'S MEASURING VESSEL.

A device for conveniently drawing and measuring oil or other liquids from a barrel or tank is shown in the accompanying illustration, and has been patented by Mr. Charles W. Proctor, of Lake Forest, Ill. The tank or barrel from which the liquid is to be drawn may be placed at a distance, outside of a house or store if desired, while the measuring device is placed where most convenient, there being a flexible pipe connection, with



A LIQUID MEASURING DEVICE.

the proper faucets, between the barrel and the measuring device. The measuring vessel has a central sleeve through which passes a suitable portable post, on which the vessel is held at the desired height by means of a thumbscrew, and within the vessel is a float, an upwardly extending rod from which slides in a sleeve at the top. On the upper end of the rod is a pointer adapted to indicate gallons and subdivisions, or other measurements, on a suitably arranged scale, the graduations being relative to the cubic contents of the vessel. As liquid is admitted from the barrel or tank to the measuring vessel, the float rises, until, when the pointer on the scale shows that the desired quantity has been drawn, the faucet in the supply pipe is closed, and the measured liquid is then allowed to flow through a flexible tube to the receptacle designed to receive the measured liquid. The measuring vessel is lowered on the post as may be necessary to bring it below the level of the liquid in the tank or barrel.

McBRIDE'S OBSERVATORY SLEEPER.

Probably at no former period has traveling been more extensively indulged in for pleasure, profit, and education than at present. Our great transcontinental railroads now afford such facilities for travel that the longest journeys can be made almost entirely without fatigue, and in the most luxurious manner, the traveler being all the while presented with constantly changing views of our valleys, plains, and mountains. Every portion of the country is attractive; the great prairies have a special interest to those accustomed to the hills and dales of the East, and the scenery of the South is comparatively new to the residents of the North, and *vice versa*.

During the past few years, in order to still more largely attract tourists, cars of new and beautiful design have been made, and money has been spent lavishly in adding to the comforts of the traveling public. A car with an end observatory compartment looking backward has been very much appreciated, excepting, as sometimes happens, when another car is attached behind; and an open observatory car for the better observation of mountain scenery has met with great favor, even though it does expose the traveler to the tempest, dust, cinders, etc., and the chilling air of the glacier regions. To obviate these objections, a special form of car has been constructed, known as "McBride's observatory," shown in the accompanying illustrations.

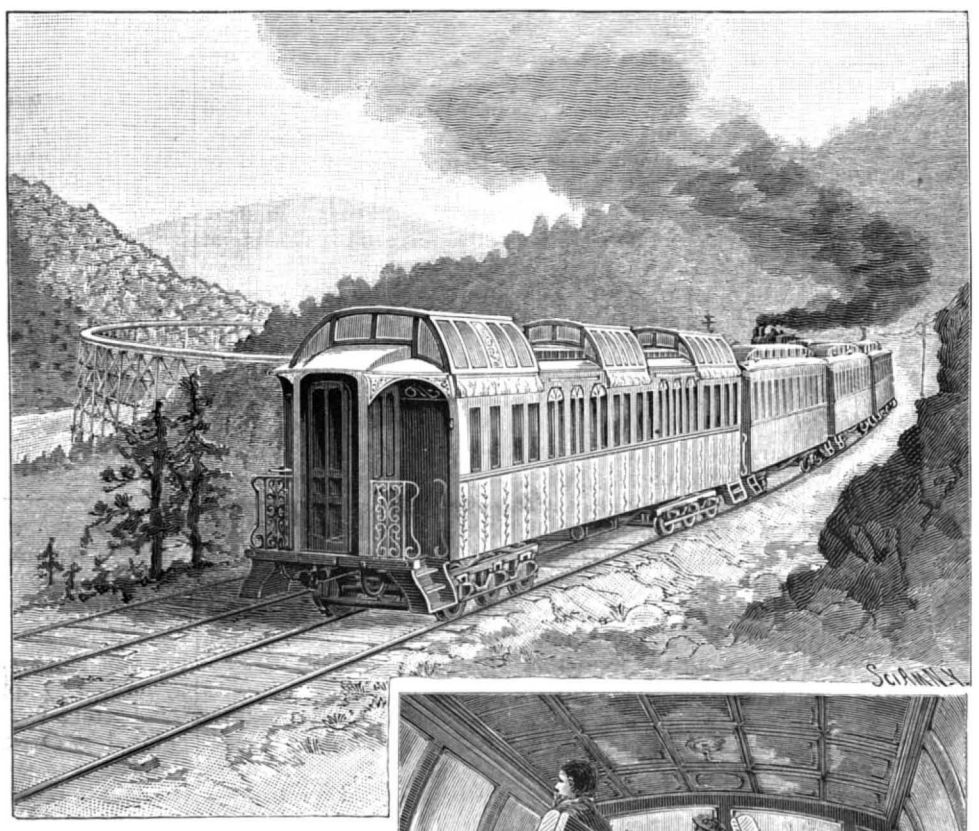
This construction also improves the lower berths by making extra head room, and adds to the seating capacity of the car without reducing the number of sleeping berths. The lower berths in the center observatory section are the most roomy, airy, and in every way the most desirable in the body of the car, while the observatory seats may be converted into upper berths, easy of access, and roomy, and always the most attractive day seats in the car.

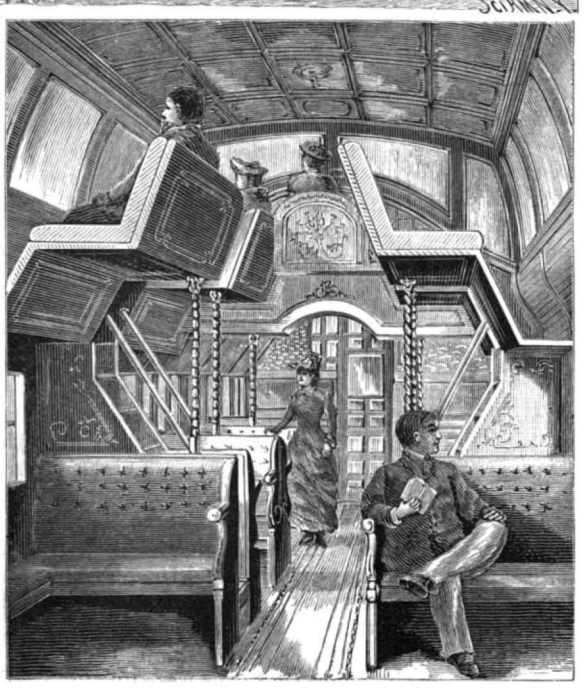
McBride's patented design applies to the whole car, the end observatories, or an observatory over the lavatories or smoking room, leaving most of the space now occupied as a smoking room for other purposes. This new observatory car is constructed so that the present make-up of a sleeper need not be impaired. Three observatory sections are used preferably on the car, so as to give the greatest number of inmates an end, as well as a side, lookout. Passengers in the center observatory get practically the same view as those at the ends, but at a different angle.

By the arrangement shown, the space occupied by the four upper center berths of the car is used as a center observatory, and in the space now occupied by those four upper berths and across their ends twelve extra observatory sittings are provided, which may be easily converted into four comfortable sleeping berths in this part of the car. Provision has been made for storing the bedding of the upper and lower berths of the observatory sections, which is even more convenient than the system now in use. The backs of the two lower center seats on each side are spaced apart, and a safe, easy stair with hand rail rises gradually from the edge of the center aisle, so as to effect a landing at the side of the car, back of the space now occupied by the upper berths. Here a seat is placed to the right and another to the left from the landing, and from which end or cross seats are reached, having their foot rests supported over and in line with the back of the seats below. The foot rests for the side and extreme end seats are placed against, or slightly over, the walls of the car, and the whole arrangement does not take from the body or inside of the car many inches more than the space usually occupied by the upper berth when folded up and out of the way.

When a traveler is seated at the side he faces a large 40 inch window, made slightly curvilinear, extending upward from the knee line to the car eaves, which will enable him to view the highest mountain peak, and to the right or left of those seats, and from the various end cross seats, a full view is had of the train top, engine, roadbed, and scenery to the right, left, front and rear. A forward balcony view is also given from the end or cross observatory seats of the lower portion of the car, and all the center aisle of the car is left clear and open from the floor to the roof.

Should any of the old Eastern roads have tunnels or bridges lower than 15 feet from the rail, Mr. McBride proposes to use only on such roads the side observatory seats, giving a side view and an end lookout over the lower portion of the train top; but for all roads having a clearance of 15 feet above the rail, and 8 feet across, at 14 feet above the rail, there will be nothing to prevent raising the observatory sections to the highest point which will ever be required, or say 18 inches higher than the ridge of the old car roof. The construction shown has been patented by Mr. T. J. McBride, Winnipeg, Manitoba, the patent also covering the location and construction of the seats, etc., which make it possible to build a car as described without raising the old central roof over 15 or 18 inches and without interfering with the main central interior part of the car as now used.

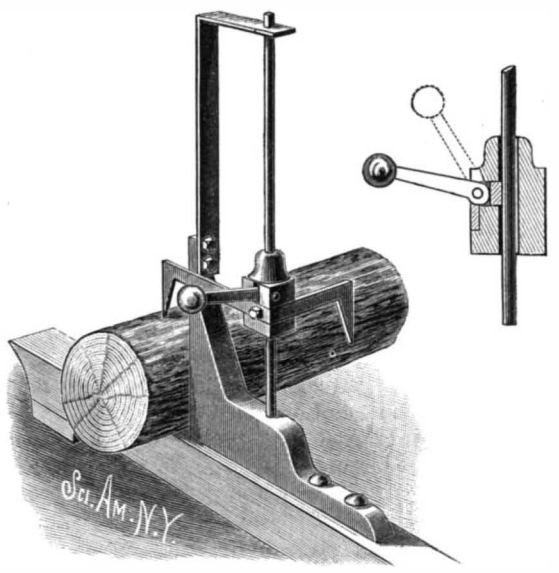




McBRIDE'S OBSERVATORY SLEEPER.

PROUTY'S SAW-MILL DOG.

The saw-mill dog shown in the cut is of very simple construction, and can be readily connected with or dis-



AN EASILY APPLIED SAW-MILL DOG

connected from the log, which it is adapted to engage near the middle on top or on the last cut. It has been patented by Mr. Wm. H. Prouty, of Worthville, N. Y. The dog proper has two arms, one slightly longer than the other, at right angles to each other. In the rear of the usual knee on the head-block is a vertical rod, whose square upper end is held in a bracket, and on the rod turns and slides a block whose lower part is square, and on two sides of which is fastened the dog. In the block is an opening in which is fitted a key whose inner surface rests against the rod, as shown in the small view, the key being pressed against on its outer side by a cam formed on the inner end of a lever fulcrumed in the block. The outer end of the lever terminates in a ball, or is weighted, so that it will normally assume a horizontal position, pressing the cam against the key, whereby the block is locked in position on the rod. To disconnect the dog from engagement with a log, the operator raises the lever, as shown in dotted lines, whereby the block is unlocked from the rod, and by pulling on the lever the block may be raised and turned as desired to use either the long or short arm of the dog. It is designed that the block, with the dog and the lever, shall be sufficiently heavy to drive the point of the dog into the log, and make a practical engagement therewith, as the lever is dropped.

Around the World for Five Cents.

A correspondent, Mr. Charles Scotte, of Epernay, France, has sent us the fac-simile of an envelope that was sent around the world for 25 centimes—5 cents. The letter was mailed at Epernay, December 19, 1890, by the regular mail for Yokohama, Japan, *via* Havre and New York. As the person to whom the letter was addressed was unknown in Yokohama, the letter was returned, reaching Epernay on March 14, having made the circuit of the world in 84 days. The post marks indicated the route and time consumed in transit. They were as follows: Epernay, December 19, 1890; Paris, December 20, 1890; New York, January 1, 1891; San Francisco, January 10; Yokohama, February 4; Hong-Kong, February 10; Marseilles, March 13; and Epernay, March 14. The letter was brought to Marseilles by the packet Saghalien. In point of speed this record is not equal to the imaginary journey of Phineas Fogg, or the real record of Nelly Bly, who did the journey in 72 days 6 hours.

ELECTRIC wands are now used in beast taming.

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BOOMER & BOSCHERT BALING PRESSES.

These presses are of the power-driven elbow joint type. The power is taken from a countershaft by chain belt and sprocket wheels so as to largely multiply the power received. A double set of elbow or toggle joints are the agency for converting the rotary into vertical motion. The general construction is obvious. In some particulars the construction shown deserves special notice. The horizontal screw is of steel, of large size, and is driven from both ends in the heavier presses. The screw nuts are of solid bronze, securing great strength and capability of wearing well. The beams and girts are made of the best rock maple. To secure the top and bottom beams, iron rods 2¼ inches in diameter are employed in the press shown. This insures greater strength and compactness than where wood alone is used to secure the press against the vertical strain.

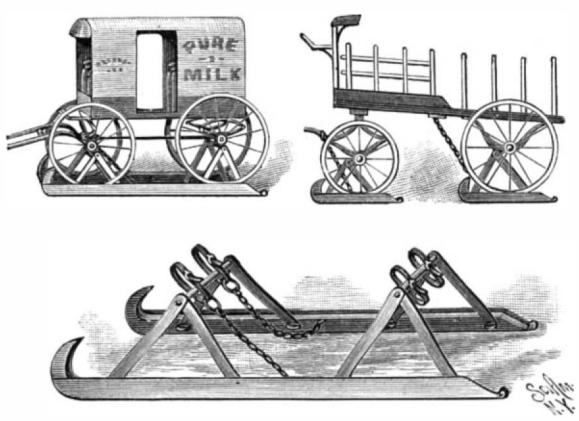
To introduce the material, the top is moved to one side. To render this easy, it is carried on rollers and is rolled to one side upon the rails extending to the rear of the top, as shown in the cut, when the press is to be filled.

Such a press as shown stands 16 feet in height, gives a movement of 5 feet to the follower, and turns out a bale 24 by 30 by 48 inches for smaller sizes, up to 28 by 36 by 60 inches for larger sizes. This press is designed especially for rags, cotton waste, etc. Many other kinds including hydraulic and screw presses are made by the same firm, adapted for almost every use requiring great pressure.

For fuller particulars the Boomer & Boschert Press Company, 354 West Water St., Syracuse, N. Y., may be addressed.

RADLEY'S REMOVABLE SLEIGH-RUNNER.

Owners of wagons of every description, and who wish they had sleighs instead when snow is on the ground, will be interested in the special construction of sleigh runners shown in the accompanying illustration, which forms the subject of a patent recently issued to Mr. John Radley, of No. 104 Manhattan Avenue, Jersey City Heights, N. J. The parts are designed to be readily separated or put together without the use of tools, and may be conveniently carried in the vehicle to which they are to be applied. Besides the usual tires, the runners have each a side shield, extending slightly above the surface of the runner, and in the runners are set threaded blocks, in which are removably secured, by means of thumb-screws, the lower



A SLEIGH-RUNNER FOR WHEEL VEHICLES.

ends of wrought iron legs, bent inwardly in their upper portion to pass clear of the hubs. The legs are designed to be all of the same length, and to be adapted to the varying heights of axles by changing their place of attachment to the runner. At the top, the legs are pivoted together in pairs respectively on each end of a cross-bar adapted to be secured to the axle, each cross-bar having loops provided with straps and buckles. For use with the front axle a chain attachment is also provided, to form a complete check on the revolving gear and fasten it more firmly to the sleigh. The double sleigh-runners are only intended for heavy trucks, to promote convenience in turning, etc., and are in all respects similar to the runners for a single sleigh. These runners can be removed from a vehicle in a few minutes, should the sleighing become poor, or they can be as readily applied when desired. Should the wagon be too heavy to pull into position on the runners, to make the attachment, the thumb-screws securing one of each pair of legs may be removed, allowing the cross-bars to drop down, when the horse may be employed to pull the vehicle on the runners.

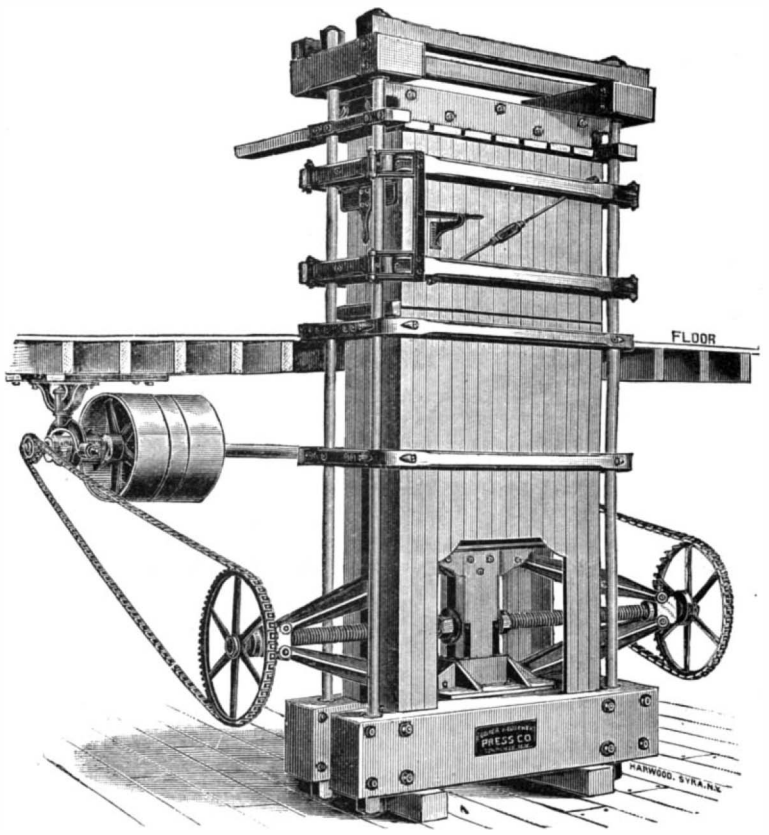
THE Académie des Sciences has submitted a new system of musical notation in which twenty-seven characters replace the 203 symbols now employed to represent the seven notes of the gamut in the seven keys.

Large Locomotives.

Four monster locomotives have lately been built for the St. Clair Tunnel Company by the Baldwin Locomotive Works. So far as known by the company they are the heaviest single locomotives ever built. Each of the four locomotives is expected and guaranteed by the builders to haul a load of 760 gross tons of cars and lading up a grade of 105 feet to the mile. This is equivalent to a train of 25 or 30 loaded freight cars. The St. Clair Tunnel Company, for which the locomotives have been built, controls the line of railroad running through the tunnel under the St. Clair River. It is near the junction of the St. Clair River with Lake Huron and connects the towns of Port Sarnia, Ontario, and Port Huron, Michigan. The line of railroad which runs through the tunnel is the connection of the Grand Trunk Railway of Canada with its line in Michigan. The tunnel is 6,000 feet long, and the approaches are 1,950 and 2,500 respectively, making a total length of over two miles. These approaches have a grade of 105 feet to the mile, and a very heavy locomotive is required to haul heavy trains through the tunnel and up the grade of the approaches.

The locomotives are of the class known as tank locomotives, and have no tender. The tanks are on both sides of the boiler, and their capacity is 2,000 gallons. The space for the fuel, which is anthracite coal, is on the footboard. There are five pairs of driving wheels, which are the only wheels, and they are 50 inches in diameter. The wheel base is 18 feet 3 inches. The cylinders are 22 inches in diameter and have a stroke of 28 inches. The boiler is of steel, five-eighths of an inch thick, and is 6 feet 2 inches in diameter. There are 280 flues, 2¼ inches in diameter and 13 feet 6 inches long. The firebox is 11 feet long and 3½ feet wide.

The cab is placed on top of the boiler and midway between its ends. There are two sand boxes, one on the front of the boiler and one on the back, so that sand can be placed on the rails whether the locomotive is running forward or backward. There is a powerful air brake which operates on each driving wheel. There are headlights and steps at both ends, like those of a shifting engine. The locomotive will run on 100 pound rails. In working order the weight is 195,000 pounds.



EXTRA HEAVY RAG BALING PRESS.

Utilization of Sawdust and Shavings.

These practically waste substances are turned to account by M. Calmant, of Paris, for the production of a finely divided vegetable charcoal, which is intended to be applied for the removal of unpleasant flavor in ordinary French wine, otherwise unsalable as wine, although suitable for distillation. The charcoal is also available as a filtering medium, especially in distilleries, where it is said to be capable of filtering forty times its volume of alcohol, whereas the vegetable charcoal of commerce, gradually becoming scarcer and dearer, and which requires grinding and often recarbonization, will only filter about three times its volume. If not already separate, the sawdust of hard and soft woods must be separated, because the former requires a heat of 700° Centigrade, whereas 500° Centigrade suffice for carbonizing the latter. Carbonization, which lasts about an hour, is effected in fire clay, plumbago or cast iron retorts, of about 600 cubic inches capacity. But previous to this process the sawdust must be sifted, first through a coarse screen to remove splinters and extraneous matter, and then through a fine sieve, which only permits passage of the actual wood dust with the adherent calcareous matter. The product of carbonization must again be sifted to get rid of this calcareous matter which has become detached during the process, when it will, if the operation has been carefully performed, resist the action of hydrochloric acid. Shavings of either hard or soft woods, also kept separate, must be subjected to preliminary treatment (which consists in a beating, to detach the adherent dust, and then a high degree of compression in a hydraulic or other press), when they are carbonized in the same manner as the sawdust, and then ground in a mill to reduce them to the same degree of fineness. Great care must be exercised to prevent the charcoal absorbing moisture from the atmosphere, and with this object it must be inclosed in air-tight recipients till required.

The Stanford University.

Senator Leland Stanford has chosen for president of his new university Dr. David S. Jordan, who has been president of the Indiana University for the past seven years. The term of office at Palo Alto will begin next September, the salary being $10,000 per annum and residence. Professor Jordan is a scientist of acknowledged ability and standing, and has had also abundant experience as an educator. He is a broad-minded man of great energy and activity, who should be just the one to organize and equip the new institution of learning. For several years he has been president of the Indiana State University, having been selected for the position because of his large executive capacity. He is about forty years of age.

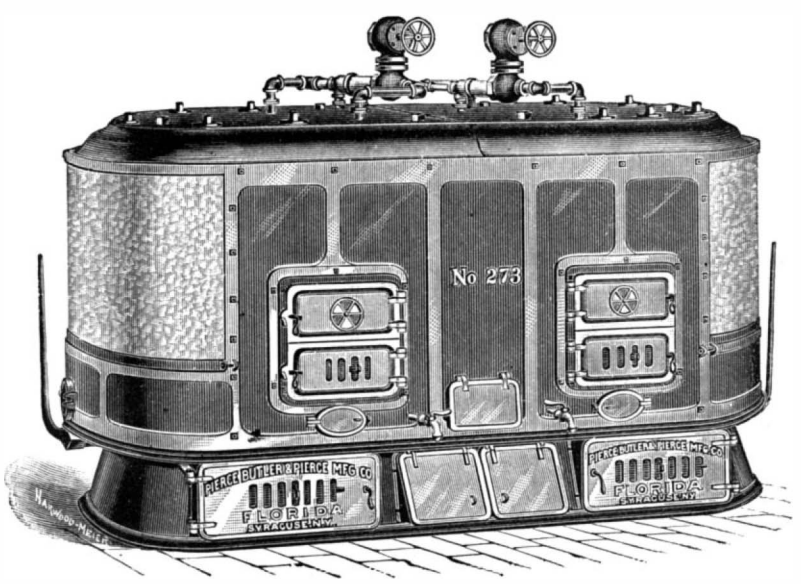
THE "FLORIDA" HEATER FOR SOFT COAL.

The heater shown in the accompanying cut is made for warming all classes of buildings by steam or hot water circulation and is designed for soft coal combustion. The idea of its construction is by large exposure of heating surface to effect economy in fuel, and by a properly designed flue system and by surface burning to avoid smoke. It is really a substitute for the expensive and heavy tubular boiler. It is made in sections, each representing a deeply corrugated and very peculiarly shaped ring. Within a series of such annular compartments the water is contained. The sections are of such size that a couple of men can handle them and set them up. All parts are accessible for cleaning purposes. The complete set of heating chambers as set up are surrounded by a galvanized iron jacketing like any portable furnace. The jackets are also lined with asbestos, thus economizing fuel.

The number of square feet of radiator surface that a single heater will supply varies with its size, ranging from 250 to 7,300 square feet.

As the heater presents every appearance of an ordinary furnace, no special provision is needed for it. It can go wherever a hot air furnace can be placed.

For further particulars as to this heater and its adaptability to particular requirements, address the manufacturers, the Pierce, Butler & Pierce Manufacturing Company, Syracuse, N. Y., U. S. A.



IMPROVED "FLORIDA" SOFT COAL HEATER.

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Items which Interested the Publishers.

To hear encouraging words from one's contemporaries is always gratifying to publishers. And probably there are few, if any, of the conductors of newspapers in this city more favored in this respect than are the publishers of this paper.

It is seldom we allude to ourselves in these columns, or to what others say of us, but we claim the indulgence of our readers for the space required to copy notices of three of our publications selected from a huge pile of similar ones taken from papers published in every State of the Union.

Of the SCIENTIFIC AMERICAN, the Toledo *Medical Compend* says: "No publication comes to our table that is more highly prized than this old substantial journal. Aside from keeping the public fully posted respecting new inventions and scientific developments, it contains a vast amount of the practical and useful. The engravings are of remarkably high order, and matter accompanying them is so tersely put that such subjects as might, under ordinary circumstances, be considered dry and heavy are not only readable, but highly enjoyable. It is the best conducted scientific journal in the United States, as well as being typographically the handsomest. Its circulation is larger than all the others of its class combined."

Of the ARCHITECT AND BUILDER EDITION of the SCIENTIFIC AMERICAN, *Light*, a newspaper published at Worcester, Mass., says: "If one could only realize all the dreams of the architect in this April number, what beautiful homes we might have! It is true that some of them are not excessively expensive, but houses that cost even a few thousand are beyond the reach of many readers of *Light*. Perhaps the most reasonable design is that of a house costing $2,700. Of this there are three views, besides plans for the two floors. Such a building is perfectly feasible to the man who is paying fifteen or twenty dollars a month rent. By the aid of our co-operative banks he could pay for the structure in a few years, and thus have a beautiful home of his own. The illustrations and description range upward to the palatial home in the great city. The April number of the ARCHITECT AND BUILDER EDITION also contains a very interesting page of cuts illustrative of English village houses."

And now comes what Colonel Church, author of the biography of Captain Ericsson, and editor of the *Army and Navy Journal*, has to say of "Experimental Science:" "It is illustrated by more than 680 engravings and is a complete encyclopedia of physics, teaching by the experimental methods and converting the dry studies which once oppressed the classroom into an exhilarating pastime. It may, indeed, serve as a substitute for the 'Boy's Own Book' of an early day, carrying the young student and experimenter as far beyond the possibilities of his father's youthful studies as modern science is in advance of the learning of an earlier day. The solution of all of the problems is within the possibilities of simple arithmetical methods. The material for the work is furnished by articles in that fascinating and useful publication, the SCIENTIFIC AMERICAN. These have been revised or rewritten with copious additions and engravings that are far superior in clearness and interest to the conventional illustrations of the ordinary text books. A lad of 16 to whom we have given the volume," the colonel adds, "finds it of unfailing interest. The variety of experiment is endless."

Gun Cotton.

In a recent lecture on gun cotton delivered by Prof. Munroe, of the Torpedo Station at Newport, the lecturer declared that gun cotton, correctly prepared and handled according to directions, was the safest of explosives to use. It was dangerous only when the matrials had not been thoroughly purified, or the union of acid and cotton incomplete.

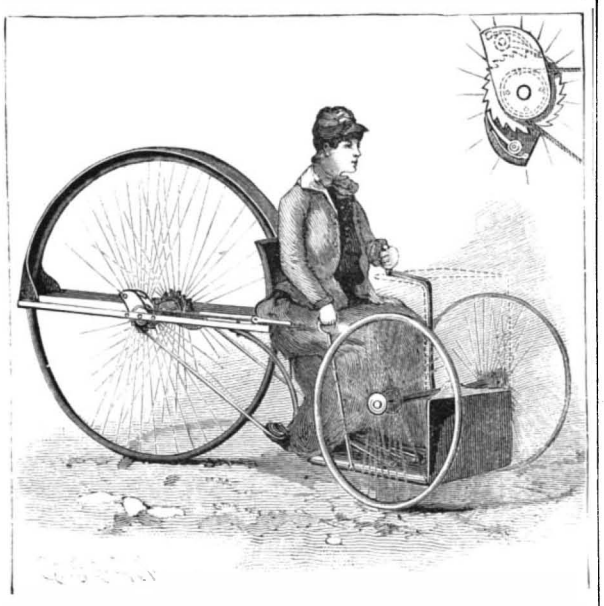
In proof of what could be done with it, a picture was thrown upon the screen showing the workman cutting it with chisel, jig saw, and lathe to fit it into a shell. Another illustration was the extinguishing of a block that was burning by pouring water upon it. Two thousand pounds of it had been burned in a bonfire without explosion.

One volume of the explosive gives 829 of the gas, and the pressure developed by combustion is 81 tons to the square inch, and by detonation 157·5 tons, the latter being in contact, however. The effect of the explosion of one particle on another is so rapid that it would take only one second for it to pass through 19,000 feet of the explosive.

It was shown by the stereopticon that the letters U. S. N., with the date of manufacture, that are in the bottom of each block, are impressed upon an iron plate upon which the gun cotton may be exploded. It is a curious fact that, if the marks on the block are in relief, the reproduction on the iron will be raised · and if cut in, there will be an indentation on the plate. Prof. Munroe's theory is that when the letters are cut into the explosives, the gases generated in the indentations are hurled from them as a projectile from a gun. If a leaf or a delicate piece of lace be laid between the gun-cotton and the iron, its impress will be left in all the perfection of outline of the original, though the article itself is absolutely annihilated.

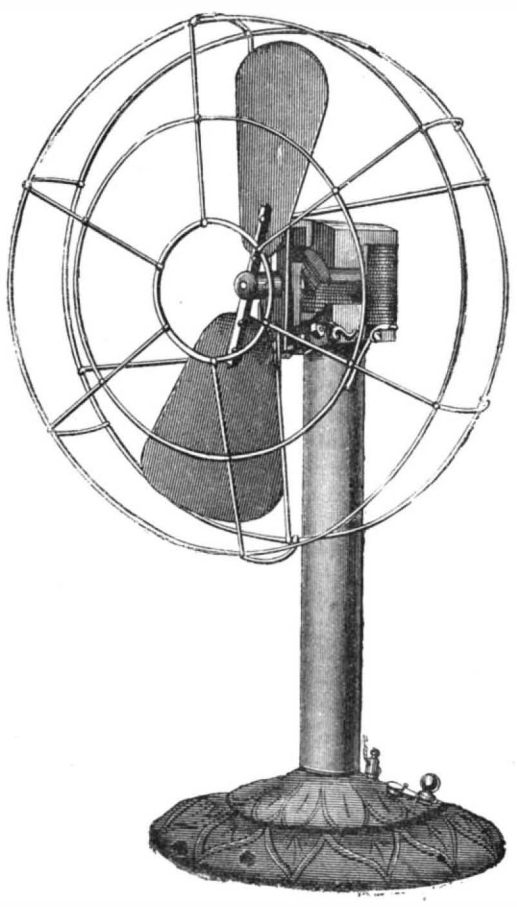
AN IMPROVED VELOCIPEDE.

The machine shown in the illustration is designed to be readily propelled over heavy grades, having means for regulating the application of power therefor, and is adapted for use by ladies as well as gentlemen. It has been patented by Mr. Andrew W. Schieding, of Turner's Falls, Mass. The large driving wheel has bearings in a horizontal frame, a forward extension from which drops nearly to the ground, and in this portion is



SCHIEDING'S VELOCIPEDE.

pivoted the axle on which the forward wheels are mounted. A top, indicated by dotted lines, is designed to cover the front portion of the vehicle, which it may be made to cover wholly, with suitable doors. Mounted loosely on each end of the hub of the driving axle are skeleton pulleys, the inner flange of each pulley having a radially projecting extension, as shown in the small detail view. To each of these extensions is pivoted a spring-pressed pawl engaging the teeth of a ratchet wheel on the end of the hub. Pivoted near the front axle are treadles, which have rearwardly extending side pieces in which are pivoted pedals. On the outer side piece of each treadle are lugs to which the operating cable is attached, the lugs being so placed as to give an increased or diminished leverage. The cable extends from the lug over one of two pulleys pivoted in opposite sides of the frame just back of the seat, thence once around one of the skeleton pulleys on the driving wheel axle, thence around two pulleys pivoted at opposite sides of the machine near the ground, in front of the driving wheel, and thence around the opposite skeleton pulley on the driving wheel axle, and back over the



DESK FAN OR SMALL DENTAL MOTOR.

pulley back of the seat to attachment with a lug on the opposite treadle. On the rotating of the skeleton pulleys by the cable, as the treadles are depressed, the pawls on these pulleys engage the ratchet teeth on the hub of the driving wheel to operate the latter. To increase the power, the ends of the cable are attached to other lugs on the treadles nearer their pivotal point, the speed being correspondingly diminished. A rod extending along the sides and across the back of the seat has its rear portion formed into a crank on which a brake shoe is pivoted, in position to be conveniently applied to the rim of the driving wheel. A lever attached to a plate on the front axle extends upwardly and rearwardly toward the seat, and by turning this lever the operator can readily steer the machine to the right or left. A tug is attached to the lower forward portion of the frame, with a handle or loop, for use when the velocipede is to be driven up a steep grade, thus increasing the power to press upon the treadles. With the aid of the tug, from which a strap may be extended over the shoulders if desired, and the increase of power to be obtained by the attachment of the ends of the cable to the lugs in the central part of the treadles, very great advantages are obtained when the grade is exceptionally heavy. The machine is readily operated by a rider in either a standing or a sitting position.

Energy.

Before the Thomson Scientific Club, at Lynn, Professor Thomson recently delivered a very interesting address on "Energy."

Formerly, he said, matter was considered as the thing that existed, and force the something that acted upon it. Energy is a term used to express something which we do not always understand. It exists everywhere so far as we know. Matter was considered indestructible. If we admit that energy can act on energy, we have no need of the old matter and force. We can see the changes in energy, though we cannot discover the thing itself. We have potential and active energy. Potential is simply stored energy, power to do work. The water in the reservoir is the same as the water a hundred feet lower, but it can do work that the other cannot, because it has energy stored in it. When that water is running down the hill and turning the wheel, it shows its actual energy. The earth revolving is another case of stored-up energy, as is also a wheel in motion. A spring is an example of elastic energy. In a boiler we have kinetic energy transformed from the heat of the fire. These are all mechanical forms of energy. The cannon ball shot into the air shows energy of motion in its ascent. When it reaches the highest point, it has energy of position. When it strikes the ground and bounds, it shows elastic energy. Besides this there is energy of temperature, which the hot cannon ball possesses. This is called molecular energy. If we could take all the heat out of anything, it would become liquid and then frozen. This has been done even to air. There is another or electric energy, another chemical and another radiant. Every form of energy is convertible into any other, sometimes at so great waste as to be impracticable for use. In converting mechanical energy into heat it is almost perfectly efficient, but in converting heat to mechanical motion ninety per cent is lost. The energy of heat is disorganized as contrasted with the organized, direct energy of motion. A disorganized army, each soldier going his own way, can do little. The tendency in nature is to degrade energy.

DESK FAN OR SMALL DENTAL MOTOR.

A small motor of new design and high efficiency, intended particularly for use in connection with a desk fan or dental motor, has recently been introduced. It may be used for any work requiring light power. The working parts are substantial, and not liable to wear or get out of order in any way.

It may be operated by an acid primary battery at a cost of not exceeding seven cents for ten hours' continuous service.

The motor may also be operated by a storage or secondary battery, charged from a simple and efficient primary battery. It is easily set up and requires little care. It may be located in any convenient closet or cellar, and connected with a small storage battery and the motor. A switch on the motor is arranged so that when it is thrown so as to stop the fan, it connects the primary with storage battery; the latter being, therefore, charging during all the time that the motor is not in use. A fan or light power motor is thus made available anywhere on short notice, in the sick room, in the office or library, or in any place where it can administer to the comfort or convenience of the occupant.

The same battery can be used to ring bells, operate signals, or do any similar electrical work that may be desired.

The motor and blades of fan are all finished in nickel, and the outfit will be an ornament in any location.

The motor, as fitted up for shipment, has the fan attachment, that being the service that is most often desired.

This motor is manufactured by the Novelty Electric Company, of 52 North Fourth Street, Philadelphia, Pa. It also manufactures electric motors for fans and other light power, of high efficiency, for use in incandescent light circuits, ⅛, ¼, and ½ horse power, and small dynamos, 2, 4, 8, and 20 16-candle power incandescent lamp capacity. Also annunciators, electric bells and burglar alarms.

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Correspondence.

One Source of Fires.

To the Editor of the Scientific American:

That a building could be burned by a telephone was demonstrated a few nights ago across the hall from my office. By some means the electric light wires in the street communicated with the telephone wires, which set fire to the telephone box. When discovered everything was in a bright blaze. Only a little while longer and an unknown conflagration would have occurred. The night was very damp, which aided the light current in passing to the telephone wires.

Atlanta, Ga. B. H. CATCHING.

Rain Conditions—A Note by Prof. Carl Myers.

To the Editor of the Scientific American:

I note that the article in the SCIENTIFIC AMERICAN, December 20, 1890, entitled "The Artificial Production of Rain," near the close quotes the opinion of H. C. Russell as follows: "Our only chance would be to take advantage of a time when the atmosphere is in a condition of unstable equilibrium, or when a cold current overlies a warm one. If under these conditions we could set the warm current moving upwardly and once flowing into the cold one, a considerable quantity of rain might fall, but this favorable condition seldom exists in nature."

The experience of the well known lady aeronaut Carlotta, as well as my own, is directly contrary to the idea of infrequency conveyed. The condition of a cold current overlying a warm one is common enough, and when ascensions were made immediately preceding rain, or several hours before it, a warm current was already established upward, and the air was warm and moist all the way up, and rain was invariably predicted by us after such observations, which were frequently made during the afternoons of July 4, which day seems to be especially favorable to balloon ascensions, atmospheric disturbances through concussions, and consequent rainfalls. CARL E. MYERS.

Frankfort, Herkimer County, N. Y., April 6, 1891.

A Nozzle Holder Wanted.

To the Editor of the Scientific American:

It has been proved by experience in this part of Florida that steam-pumped water can be used successfully and profitably for irrigating orange groves and truck farms. The soil is so loose that water will not run on the surface at all, and the only practical mode of applying the water, in most places where it has been tried, is to spray it by pressure and let it fall as in ordinary lawn irrigation. What is known as the "Holly system" is used; that is to say, an ordinary pumping station is erected at the water, pipes are laid over the ground to be irrigated, a regulator or governor is so adjusted that the back pressure will cut off the steam from the pump when the pressure in the pipes reaches the desired limit. By this means a practically uniform pressure can be maintained sufficient to spray the water. A main pipe leads from the pumping station through the field to be irrigated, and from this laterals run to the edge of the field, and on these lateral pipes hydrants are placed at convenient distances.

With a 6 inch main, 4 inch lateral, and 3 inch hose, and a pressure of 130 pounds, water can be thrown from an inch and a quarter nozzle 100 feet, and a circular area 200 feet in diameter can be irrigated without changing the location of the nozzle. But to do this the nozzle must be held at an angle of 45° to the horizon, and moved around at that angle. This distributes the water over a circular strip 16 feet wide. The nozzle must then be raised so that the outer limit of the water will fall 16 feet nearer the nozzle; a circuit of the nozzle at this angle irrigates another strip inside the first. This is continued, the nozzle being elevated and moved more rapidly at each circuit until the nozzle points to the zenith, when in a few moments the ground immediately around it receives the water. It requires, with pipes, hose, and nozzle such as I have described, about 40 minutes to distribute 9,000 gallons of water (one-third of an inch over the entire surface) on the circular area 200 feet in diameter. The distribution is very uniform, and the water is so sprayed as not to injure the tenderest vegetation. With the ordinary sprinklers now in use it is easy to irrigate the small spaces left between the circles. But the labor of holding the nozzle is expensive. The man gets wet in spite of gum suits, and he not only requires wages above ordinary labor, which is here worth $1 per day, but he is frequently made sick.

We need an apparatus that will do this work of holding the nozzle automatically, something that will move the nozzle around at an angle of 45° at a regulated speed; then elevate the nozzle to say 53°, move it around with increased speed at that angle, then elevate it to say 60°, etc.; or the movement might begin with the nozzle pointing to the zenith and then descending in constantly widening circles until it reached an angle of 45°, that being the point at which the greatest projection is obtained. It would be better to have each circuit made with the nozzle at the same elevation during the entire circuit; but it would answer all practical purposes to have the nozzle moved along a spiral inclined plane at a uniform speed, with the angle of inclination so adjusted that the time required for each circuit of the nozzle would be in proportion to the area to be watered during the circuit. For example, only a few seconds would be required when the nozzle points to the zenith to water the small area on which the water would fall. A little longer time would be required to water the area which would be reached when the nozzle made a circuit at an angle of 85°, still more when it made a circuit at an angle of 80°, and the area watered by the nozzle at an angle of 45° being the largest, the longest time would be required for that circuit.

If the apparatus was so adjusted as to cause the nozzle to descend from the zenith to an angle of 45° to the horizon, or to ascend from this angle to the zenith in 40 minutes with uniform speed, and during the ascent or descent to make eight complete circuits, the main purpose would be accomplished.

The motion to the nozzle could probably be imparted either by a spring or by a weight, or by water power obtained from a small orifice in the side of the nozzle or hose. In watering orange trees, it would be necessary to raise the apparatus 12 to 15 feet above the ground, and it should be so constructed that it could be fastened to the top of a post placed in the ground at the center of each circuit to be irrigated.

If somebody will invent and construct an apparatus, not too costly, that will do this work, a good demand will be found for it at once, with probably a largely increased demand in the near future.

DANIEL S. TROY.

Lane Park, Lake Co., Fla., April 10, 1891.

The Camera Obscura.

To the Editor of the Scientific American:

In your issue of April 11, Mr. Nicolas Pike has an interesting article on "Photography." In this he ascribes the invention of the camera obscura to Baptist Porta. I send you some brief notes on the "History of the Magic Lantern," to show you that an earlier date should be assigned to the discovery. You may reprint the notes if you please.

H. CARRINGTON BOLTON.

New York, April 15, 1891.

NOTES ON THE HISTORY OF THE MAGIC LANTERN.

The "magic" lantern is an outgrowth of the *camera obscura*, the origin of which is unknown. Its invention is usually attributed to John Baptist Porta, but Libri (*Histoire des sciences mathematiques en Italie*, Paris, 1841, 4 volumes, octavo) has shown that it was frequently mentioned by authors of much earlier date.

The first mention of the camera obscura occurs in unpublished MSS. of the celebrated Italian painter, sculptor and architect Leonardo da Vinci. Da Vinci was born in 1452 and died in 1519. His reputation as an artist is immortal, but it is less generally known that he was well versed in music, military science, mechanics, hydraulics, astronomy, geometry, physics, natural history and anatomy. In several of these branches he made original investigations, anticipating later philosophers.

In a MS. quoted by Libri, Da Vinci proposed a theory of vision which he seeks to explain by reference to the camera obscura. (*Libri* III., 54 and 233). This takes the invention back into the 15th century—say 1490.

In a work published in 1521 by Cæsariano, a Milanese architect, he attributes the invention to a Benedictine monk, Dom Panunce, which is, however, regarded as doubtful (*Libri* IV., 303).

Cardanus, an Italian physician, mathematician and author, also mentions the camera obscura in a treatise entitled *De verum subtilitate*, published at Nuremberg in 1550.

All these references antedate John Baptist Porta's work, "De Magia Naturalis," of which the first edition appeared in 1553, when its precocious author was only 15 years of age. While Porta was not the inventor of the camera obscura in its simplest form, he has the honor of first employing a convex lens to perfect the images, and of placing transparent drawings opposite the opening. To these drawings he attached movable parts, and thus produced astonishing effects, which the unlearned ascribed to magic, a term connected with the lantern ever since.

Porta's camera obscura consisted of a simple box with a small opening at one side, through which the rays of light entered and fell upon a white paper screen at the opposite side. The lens was subsequently inserted.

The difference between a dark chamber of this construction and a magic lantern is very slight, and consists chiefly in the relative position of parts and the source of illumination. By whom the great improvement was made, of substituting artificial light for sunlight in exhibiting transparent pictures, is unknown to the writer.

Deschales in his "Mundus Mathematicus" (Leyden, 1674) states that a Dane, possibly the physician Thomas Bartholin, showed him in 1665 a lanterna magica having two convex lenses (*Pogg. Gesch. Phys.*, p. 436).

Athanasius Kircher, a learned Jesuit, professor of mathematics at the Collegio Romano (b. 1602, died 1680), in his second edition of "Ars Magna Lucis et Umbræ," 1671, describes the magic lantern.

The oxy-hydrogen light now commonly used in connection with the exhibition of pictures by the lantern was the invention of Thomas Drummond, of the Royal Engineers (b. 1797, d. 1840), who employed it in 1824 in the trigonometrical survey of Ireland. The principle on which it is based had, however, been established in 1801, by Prof. Robert Hare, of Philadelphia. To prevent explosions from the ignition of the mixed gases, Dr. Hare also applied the principle of Sir H. Davy's safety lamp, but this was not altogether satisfactory, for it did not prevent some disastrous explosions. Later the so-called "safety jet" was introduced, consisting of concentric tubes which prevent the gases, oxygen and hydrogen, from mingling previous to their issuing from the orifice. This invention is variously ascribed to Hemming, Maugham, and Daniell. The publication of the latter is dated 1833.

H. C. BOLTON, New York City.

Prevention of Damages to Sea Shores.

To the Editor of the Scientific American:

For many years severe easterly winds and storms have caused much damage at many places along the sea shore by driving the waves in upon the beach with sufficient force to wash away the sand and bluffs to an alarming extent, necessitating the moving of buildings and walks, changing of roadways, and in general ruination of valuable properties. Cape May Point has suffered probably as much as any other place along the Jersey shore. Here it is not only the easterly winds and tides driving the waves in upon the shore, but also the flood and ebb tides that run in and out of Delaware Bay, sweeping away the sand washed up by the waves.

Engineers have been consulted and many thousands of dollars spent in driving pilings to form jetties and in building strong sea walls; but all of these structures have proved but futile efforts to stop the inroads of the sea.

The storms of last fall damaged a thousand or twelve hundred feet of the front to such an extent as to require the moving of one large building back quite a distance. And as eight dwellings and two churches more would be jeopardized by another storm, the property owners became alarmed, and they called a meeting of those interested to devise some plan to save the front. At that meeting theories were advanced as to the cause of the damage and remedies needed.

It was finally decided that the cause came from the driven waves washing and loosening up the sand, some of which was carried back with every receding wave till it came in contact with the current, and was carried away to be deposited where there was no current, or where there was an obstruction formed to collect it. And the remedy would be a solid, tight jetty, to stop the current. This would form an eddy on either side of the jetty, and the sand would be collected.

A committee was appointed to enter into a contract to have one built and to be paid for by private subscription.

This jetty was completed last November, and since that time the shore has not only been saved from further damage, but on each side of the jetty the shore has made out more than 100 feet and gradually is filling out further.

The top of the sand first collects about on a level with the average tides; each storm tide that washes over the level surface of made ground carries sand further back and raises the inner shore to the top and above the reach of the highest tides.

The result in this case clearly demonstrates the feasibility of jetties to not only prevent the washing away of the shores, but to add thereto. The peculiar shape of this jetty aids in collecting sand, as it does not cause sudden resistance to waves.

Where jetties are built exposed to all storms and the pounding of the waves, it is necessary to have the strongest kind of structures to prevent them from being carried away by the force of the sea.

This plan of jetty is A-shape, which avoids sudden resistance to waves and heavy seas. There are two rows of planking sunk into the sand by hydraulic pressure, the sides being on an angle of about 45 degrees, the planks meeting at the top or ridge, and a ballast floor; all secured to a heavy framework of timbers well tied together by iron bolts, and the structure loaded with stone ballast, 1,500 or 2,000 pounds to the lineal foot.

Germantown, Pa. S. E. HUGHES.

A Five Thousand Mile Railway.

The great Russian railway from Vladivostock on the Pacific Ocean through Siberia to St. Petersburg has been ordered and operations begun. This road will be 4,810 miles long—with spurs, more than 5,000 miles in all. The cost is estimated at one hundred and sixty millions of dollars. It will open many regions rich in minerals and agricultural productions.

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VICTOR BICYCLES.

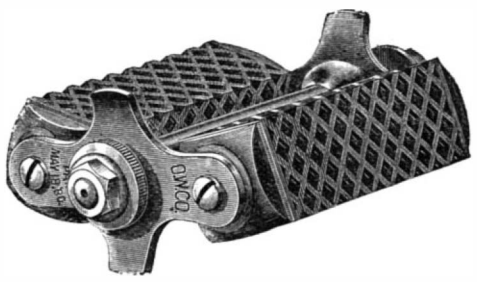
(*Continued from first page.*)

against spreading by side flanges having rounded edges which the tire covers and protects. The base of the tire rests on a horizontal rim bed which aids materially in giving lateral stiffness to the tire and strength to the hollow rim. With this construction the rubber displaces inwardly under pressure, and the movement of the rubber is almost entirely in a radial direction, a fact which accounts for the great elasticity of the Victor cushion tire.

The elasticity of the forward part of the machine is secured by the device known as the Victor spring fork, which has proved itself in actual use a device of great value. This, taken in connection with the cushion tire, insures as smooth and steady an action as could be desired. The machine is provided throughout with the finest ball bearings, and the pedals are made on a new plan original with the Overman Wheel Co. Being rectangular in section, they automatically adjust themselves to the curve of the boot and give a good bearing to the sole of the foot.

In describing such work it is natural to begin with the history of the company, but we will omit matter that is purely historical, and refer only to the concern in its present state.

The Overman Wheel Company now occupies two extensive buildings, which lie upon opposite sides of the street, and are connected by a bridge. The first of these buildings, while in process of construction, was supposed to be large enough to meet the demands of the business for many years, but before the structure



THE VICTOR SQUARE RUBBER PEDAL.

was completed it was determined that the works must be doubled, and, as a consequence, a second building was planned and proceeded with as rapidly as possible. These buildings are made of brick, with granite trimmings; the piers between the walls which support the floors are brick, with granite binders and iron caps. The floors are made of heavy matched pine plank, having a thickness of 2½ inches, covered with diagonal pine flooring, on the top of which is placed a floor of hard maple. The ceilings and timbers are covered

THE VICTOR SPRING FORK.

with asbestos and tin, thus rendering the wooden portions practically fireproof.

The success of this concern is due in no small degree to Mr. Overman's genius in planning, building, and equipping his own shop, everything of this character being done under his own eye. The growth of the business has been such that at the present time both of these extensive buildings, with all the machinery and appliances contained in them, are scarcely able to keep up with the demands of the business, even when the work is carried on night and day, as is the case during the busy season. Each of these buildings is provided with a pair of 100 h. p. engines and boilers to match, and the works are so constructed that all the

THE VICTOR BICYCLE.

machinery in both buildings may be driven by either set of engines.

The machinery employed in doing the work is the best that money can purchase or that genius can devise. As soon as the necessity for a machine for a given purpose develops itself, the machine is purchased or constructed and set at work as soon as possible. We are informed that everything which is used in the construction of the Victor machines, with the exception of the rubber tires, is made on the premises by day labor. No contract labor is allowed, and, as a rule, no workman under twenty years of age is employed, it having been found by experience that boys are apt to be not sufficiently alive to the importance of always doing their best work to justify their employment. All the workmen here employed are skilled mechanics who are proud of their work, and not only stand high as mechanics, but as citizens, as the Overman Wheel Company will not employ an individual who disgraces himself, whether in the works or out. As the machines are made entirely of steel, it is obvious that drop forging must enter largely into the process of construction. In one of our engravings is shown a view in the drop forging shop where the steel parts are forged preparatory to being shaped in milling machines and lathes. The forges in the drop forging shop are constructed double throughout, for the purpose of adapting them to the use of liquid or solid fuel. Crude petroleum is the standard fuel for heating the steel. It is atomized and blown into the forges by air under pressure. The petroleum for this purpose is taken through a private pipe line from tank cars at the railway, and stored in an underground reservoir having a capacity of several car loads. Petroleum is used under the boilers and in the hardening furnaces, and all these furnaces are so arranged that should the supply of petroleum fail, even temporarily, the coal furnaces may be immediately started and work will proceed without interruption. Besides the petroleum heating furnaces there are gas blowpipes, and furnaces supplied with gas from a private plant.

As the parts of the machines are held together mainly by screws, screw threads and nuts, a great deal of fine machinery is required to accomplish this part of the work. This is contained in the screw machine room, shown in one of our engravings. Most of the parts of the machine are carefully nickel plated in preference to japanning, or any other finish. A large force is employed in the nickel plating department, which forms the subject of one of our engravings. After plating, the parts are conveyed to the buffing room, a corner of which is illustrated.

The parts of the wheels are put together and the wheels are carefully trued and adjusted in a department devoted to that purpose, and one of the floors is used for assembling the parts of the machine. After assembling, the machines are all tested. Before the construction of the new building the machines were tested on the road, but the uncertainty of the weather made it necessary to provide a place under shelter, therefore the upper story of the new building was provided with a floor especially prepared for this purpose, the floor having pavements representing all kinds of roads, so that the behavior of the wheels on the different roads could be readily studied.

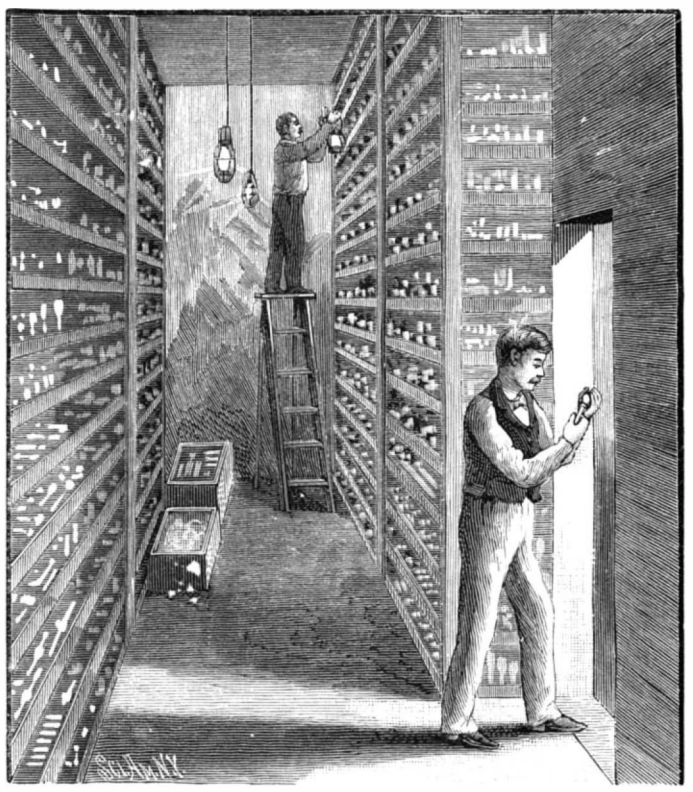
The tools used in the different departments of the establishment are kept in a fireproof vault in charge of competent attendants. They are made in triplicate and given out according to a regular system.

The illumination of the building is accomplished by an electric light plant having a capacity for one thousand 16 candle power lamps. The protection against fire is very complete, the works having a water tower on the roof, an underground reservoir with a capacity of 30,000 gallons, and a standpipe from the city works on every floor.

The works employ six hundred men at the present time, and we are informed that this number will soon be increased to one thousand.

The office from which this great activity is controlled is shown in one of the smaller engravings. Here the ruling genius presides. So far as possible every department is made to report itself through the medium of an electrical apparatus at the office. The pressure of the steam in the boilers, the temperature of the japanning ovens, the level of the water in the water reservoir, are all made to report automatically at the office. Here, also, is the master clock which controls the secondary clocks throughout the entire establishment, and connected with this clock is an engineer's signal for blowing the whistle, the signals for the closing of the gates, etc.

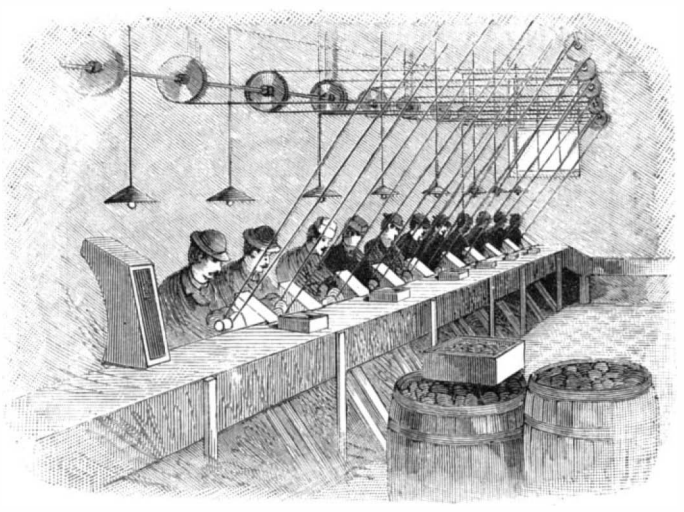
The capital stock of the Overman Wheel Company is $250,000, with a surplus of a like amount. The president of the company is A. H. Overman; treasurer, E. S. White; directors, A. H. Overman, of Springfield; George D. Seymour, New Haven; Charles E. Mitchell, Washington; and Luther White, of Chicopee. Branch houses have been established at Boston, Mass., Washington, Denver, and San Francisco, where customers



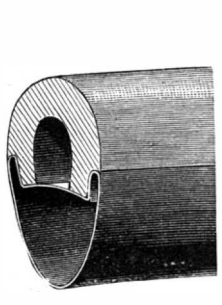
TOOL VAULT.

can make precisely the same business arrangements as at the home office.

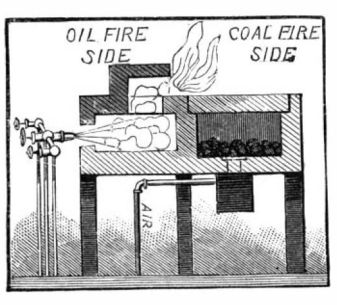
IT is recommended for the prevention of baldness that the hair be kept pretty closely cropped, and that the head be bathed frequently in salt water and lubricated occasionally with a very small quantity of vaseline. Two teaspoonfuls of salt to a pint of water will make a tonic of the proper strength, and with this the head should be bathed three times a week.—*Med. Rec.*



A CORNER OF BUFFING ROOM.



THE CUSHION TIRE.



COAL AND FUEL OIL FORGE.

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SCIENTIFIC DIVERSIONS.

Street venders are often seen selling, at night, a little mouse which they place upon the back of their hand, and which keeps running as if, having been tamed, it wished to take refuge upon them. In order to prevent it from attaining its object, they interpose the

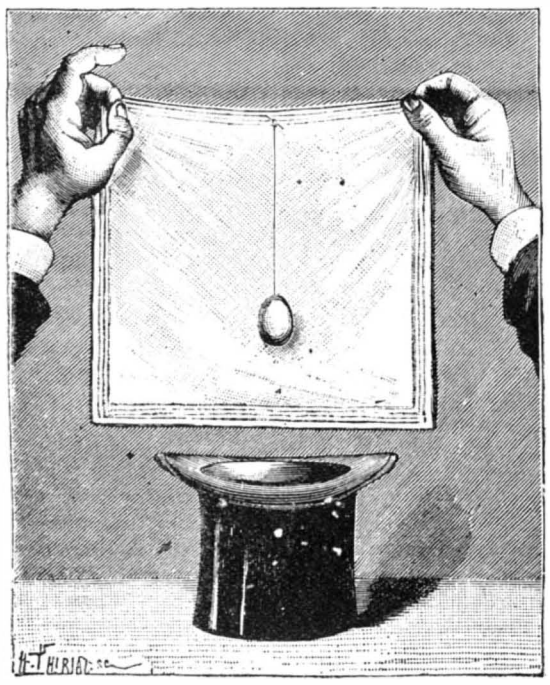


Fig. 2.—THE EGG AND HAT TRICK.

other hand, and then the first one, which is now free, and so on. The mouse keeps on running until the vender has found a purchaser for it at the moderate price of two cents, including the instructions for manipulating it, for, as may have been divined, it is not a question here of a live mouse, but of a toy. This little toy is based upon two effects—first, an effect of optics, and second, the effect due to an invisible thread.

The mouse, which is flat beneath, is provided near the head with a small hook, and the operator has fixed to a buttonhole a thread ten inches in length terminating in a loop. He fixes this loop in the hook above mentioned, and, tautening the thread, places the mouse upon the back of his left hand (near the little finger, for example).

On moving the hand away from the body, the mouse, which does not stir, seems to slide over the back of the hand, and, at the moment that it is about to fall on reaching the thumb, the right hand, passed beneath, arrives just in time to catch it near the little finger, whence, by the same movement as before, it seems to go toward the thumb (Fig. 1).

In order to perform the experiment off-hand, it suffices to take a cork and carve it into the form of a mouse, then cut away the under part of the animal thus rough-shaped, so that it may lie perfectly flat, then make two ears out of cardboard, and a tail out of a piece of twine, and finally blacken the whole in the flame of a candle. After this, the black thread, terminating in a ball of soft wax or a pin hook, having been fixed to a buttonhole, allow the spectators to examine the mouse, and, after it is returned to you, fix the thread, either by its ball of wax or its hook, to the front of the flat part of the rodent, which you may then cause to run as above described.

Another effect due to an invisible thread is the following:

Some months ago, in a Parisian public entertainment, a clown took a hat and a handkerchief and then, after showing, by spreading it out, that the handkerchief was empty, drew an egg from the folds of the crumpled fabric and allowed it to drop into the hat. Then he took up the handkerchief, shook it out again, crumpled it up, found another egg, and let it drop into the hat, and so on. When it might have been supposed that the hat contained a certain number of eggs, he turned it upside down, and, lo and behold, the hat was empty! All the eggs from the handkerchief were reduced to a single one attached by a thread to one of the sides of the handkerchief, and which the amusing operator maliciously exhibited, after seeming to look for the vanished eggs.

While the handkerchief was stretched out, the egg was behind it, and, although it was shaken, remained suspended by its thread. In crumpling the handkerchief it was easy to seem to find the egg in it, and to put it in the hat, where it did not remain, however, for, lifted by the thread, it resumed its place behind the handkerchief. Fig. 2 shows the handkerchief at the moment that the egg has been removed by the thread on the side opposite that of the spectators.

On attaching a black thread, 16 or 20 inches in length, to an empty egg, and selecting the egg thus prepared from a lot of ordinary eggs, as if by chance, we have a ready means of amusing and mystifying spectators for a long time. Having hooked the free extremity of the thread to a buttonhole of the waistcoat, let us lay the egg upon the table. After apparently ordering it to approach us, it suffices to recede from the table to make the docile egg obey the command. By the same means, it may be made to make its exit alone from a hat, or, again, by bearing upon the invisible thread, it may be made to dance upon a cane or upon the hand, in a word, to perform various operations that eggs are not accustomed to perform.—*La Nature.*

THE MAUSER MAGAZINE RIFLE.

In the Mannlicher rifle, the magazine is permanently attached to the weapon, and every cartridge used is first put into the magazine. To enable this to be done, and at the same time to raise the average rate of firing, as compared with a single loader, the cartridges are issued in sets of five carried in steel clips or holders. The complete set or bundle is placed in the magazine with nearly as great ease and celerity as a single cartridge can be placed in the body or the chamber of the rifle. After every five shots there is a momentary intermission for reloading, but it is very short. If the magazine be empty, it is quite possible to use the rifle as a single loader. This principle of loading by means of a cartridge holder which goes bodily into the magazine has been adopted in Austria and Germany.

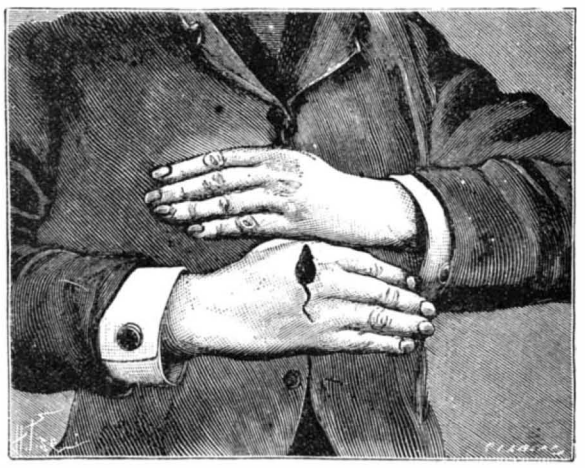
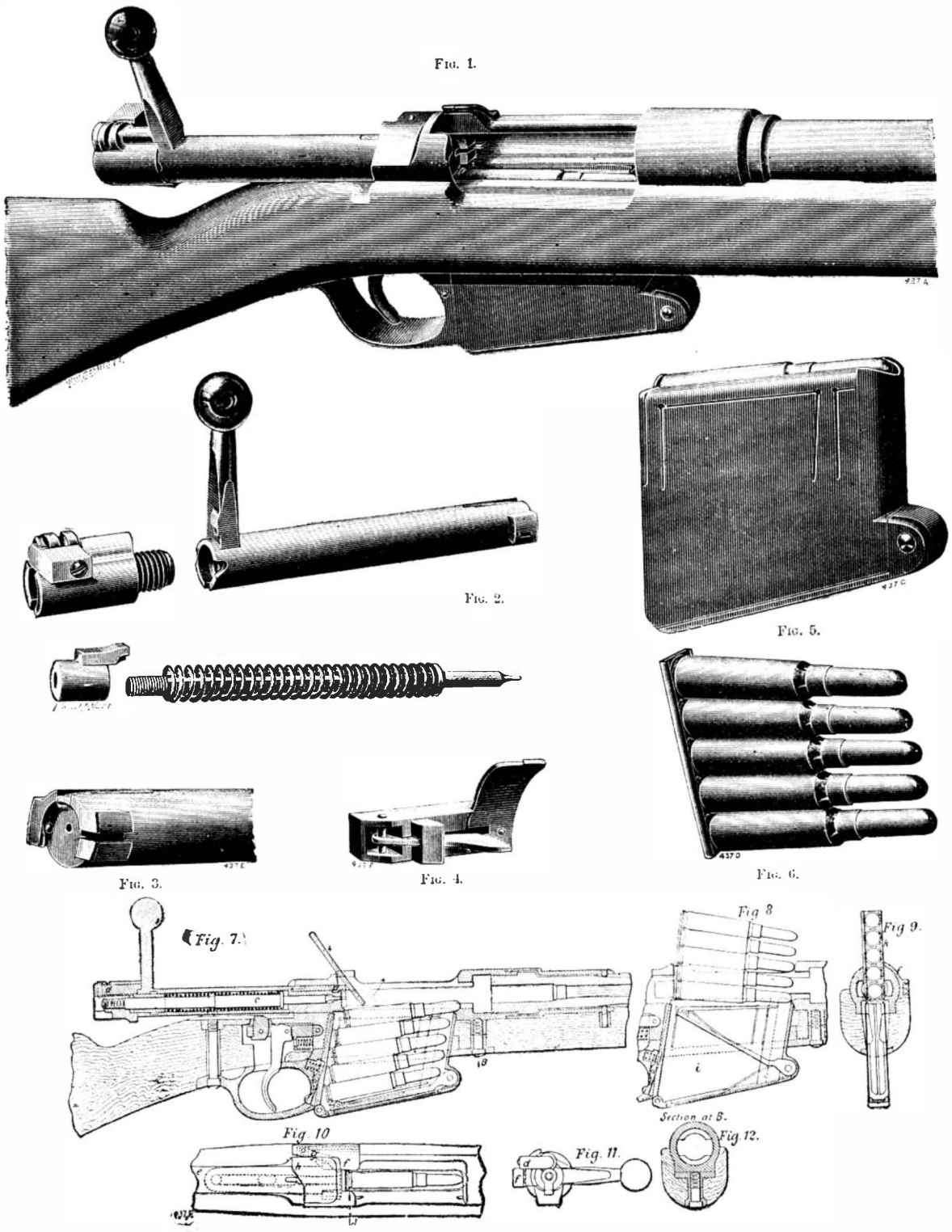


Fig. 1.—THE ANIMATED MOUSE.

A third type of magazine rifle is that invented by Mr. Mauser, and adopted by the Belgian, the Turkish and the Argentine governments. It has a magazine which, although not absolutely fixed, is not intended to be removed except at considerable intervals for purposes of cleaning. The cartridges are issued in sets of five held together by clips or holders, but these clips do not go into the magazine, and form no part of the equipment of the rifle. In other words, if the clips should become rusty, or be bent by blows or pressure in packing, the soldier would still be able to use his magazine, a condition of affairs which would not obtain if the cartridge holders had to be placed bodily in the magazine. A concurrent advantage of this arrangement is that the bottom of the magazine does not need to be left open for the clip to fall out when emptied. If an open-bottom magazine be rested on damp ground, as would be the case with the marksman lying down, mud or wet is almost certain to enter the opening, with the likelihood of rusting the interior of the magazine. Should this occur the cartridge holders would not fall out, and possibly the feeding spring itself would be rendered useless. In the Mauser system the cartridges in their holder are placed directly over the mouth of the magazine, and by pressure of the thumb are fed out of the holder into the magazine, as will be better understood when we come to describe the mechanism in detail. The holder falls away and ceases to be an element in the affair. Further, the Mauser rifle does not need a cut-off to render it a good single loader. The soldier may keep his magazine full during the early part of a fight, reloading after every shot if he likes, and thus preserving his store intact against the supreme moment. This cannot be done with either the German or Austrian rifles; they are only available as single loaders when the magazine is empty. Neither can a half-empty magazine be replenished in them without sacrificing the cartridges which it contains.

The construction and mechanism of the Mauser magazine rifle are clearly shown by the illustrations. Fig. 1 shows the body of the weapon, with the bolt



THE MAUSER MAGAZINE RIFLE.

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drawn back and the magazine full. Fig. 2 shows all the parts of the bolt with the striker. Fig. 3 is a view of the end of the bolt with the extractor. Fig. 4 is a separate view of the piece marked *f* in the details. Figs. 5 and 6 show the cartridges and their holders. Figs. 7 to 12 show details.

The system of loading by means of a temporary clip is clearly brought out in the engravings. The clip itself, *k*, is a piece of thin plate steel bent over at its edges to form a groove or rebate in which the flanges at the bases of the cartridges fit. This groove is quite open at either end, so that the cartridges are free to slide out. To prevent them chattering out during transit, or while in the soldier's pouch, a light spring, made of a piece of wavy steel ribbon, is laid in the bottom of the groove and holds the flanges of the cartridges firmly against the turned-over edges of the steel strip. The whole packet is quite firm and compact, so that it can be handled without the slightest danger of falling apart. But if pressure be applied to the cartridges in a line parallel to the clip, then they can be readily made to slide out of the groove. Provision is made in the body of the rifle (Figs. 1, 8, and 9) for holding the clip perpendicularly, or nearly so, over the mouth of the magazine in such a position that a moderate pressure applied by the thumb to the upper cartridge will feed the whole of them downward into their places. The clip is left standing, supported at the sides and the bottom by the solid metal of the rifle body, and held by the elastic pressure of the piece, *f* (Figs. 4 and 9). The first movement of the bolt (Fig. 7) throws out the clip, and the piece, *f*, springs back into place.

In the Mauser magazine the cartridges are pushed in sideways, and yet the spring does not force them out again as soon as the pressure is withdrawn. This most convenient arrangement results from the construction of the magazine, *i* (Fig. 5). The lips are turned over for nearly the entire length, but they are divided by a straight cut from the sides, and are so elastic that they readily spring apart to receive a charge. They are, however, sufficiently strong not to be opened by the elastic pressure which forces the cartridges upward. The base of the top cartridge projects above the mouth of the magazine sufficiently to be caught by the bolt, *a* (Figs. 1, 5, and 7), when it is moved forward, forcing the point of the bullet up an incline into the barrel, and thus springing apart the lips of the magazine to allow the cartridge to escape from it.

The magazine itself is exceedingly compact, not interfering with the grasp of the soldier in firing. The construction of its feeding arrangement is seen in Figs. 7 and 8. This is formed of two leaves, each acted upon by a spring. This feeding arrangement can be easily got at for cleaning or repairs. The bottom of the magazine is pivoted at its rear end, and secured by a screw at its forward end (Fig. 7). If this screw be withdrawn a few turns, the bottom of the magazine, with the spring attached to it, drops down, and a few turns more enable the feeder to be detached and withdrawn. The screw is still engaged for more than half its length in the thread, so that there is no likelihood of its being dropped and lost. The magazine is secured by a catch lever which takes into a depression in its rear end. By pressing on the button which comes through the front of the trigger guard the catch lever can be withdrawn and the magazine liberated. This operation can be performed in a few seconds, but it is not intended that it shall be carried out on the field of battle. The bottom and ends of the magazine (Fig. 8) are thick and solid, and are capable of withstanding a very severe blow, while the sides are to a very considerable extent protected by the stock. Of course any part of the magazine would be irretrievably damaged if struck by a bullet, but the same thing is true of the soldier.

The bolt is of great simplicity. Apart from its cocking arrangement, it is merely a hollow cylinder of steel with a handle at one end and two locking lugs at the other. These lugs (Figs. 2, 3, 9, and 12) slide through two grooves in the breech of the gun, and on the bolt being rotated lock behind two projections. In fact, they constitute an interrupted screw. The strain of the explosion is thus borne by the base of the bolt and the breech of the barrel and is not transmitted through the body.

The Mauser extractor (Figs. 2, 3, and 7) is a spring let into the bolt with a hook protruding into the recess which receives the base of the cartridge. In extracting, the handle of the bolt moves along an incline, *h* (Figs. 1 and 10), on the body, and in doing so it is drawn back about ⅛ in. This motion has the effect of freeing the cartridge, even if it be jammed, and while it is taking place, the soldier has very considerable leverage to aid him. The shape of the recess at the end of the bolt is worth noticing (Fig. 3), for upon it depends the extractor getting hold of the cartridges, which are made with a groove round the base.

The gate which is cut through one of the locking pieces on the end of the bolt is made to accommodate the piece, *f* (Figs. 1 and 4). A blade hinged to this piece projects into the body of the rifle and passes through the gate when the bolt is drawn back. This gate is so deep that the blade is pressed by a spring into the path of the empty case, forcing it out of the grasp of the extractor, and flinging it sideways out of the arm on to the ground. Also connected to this piece, *f*, is a stop which normally prevents the bolt being drawn out of the gun. But by pressing back the piece with the thumb the stop is withdrawn, and the bolt can be removed in less than a second. It can then be taken entirely to pieces (Fig. 2) in a couple of minutes, and this without tools. It has a very powerful mainspring. This is provided to meet the requirements of the thick cartridge cases which are likely to be employed with smokeless powders. Smokeless powders develop such high pressures that it is probable they will require more substantial cases than have been employed with black powders. There is a very neat device for preventing the cartridge being exploded before the bolt is securely locked; compared with the arrangement used in our own weapon, the simplicity is most striking. It will be seen that a deep notch is cut in the rear end of the bolt (Fig. 2) to receive the cocking catch; it is only when the bolt is securely locked that this notch is opposite the catch. If the trigger be pulled with the parts in any other position than the right one, the striker cannot reach the cartridge, and consequently the fulminate is not exploded.

To lock the rifle, so that it may not be accidentally fired, there is provided the safety appliance, *d*, on the end of the bolt (Figs. 2 and 7). This is a short spindle with a cam at each end, and a roughed thumbpiece by which it can be turned half way round. When the spindle is rotated, the cam at the front end takes into a recess on the end of the bolt, and locks the latter against being turned, while the cam at the rear end inserts itself before the nut on the end of the striker, and holds it fixed.

The barrel is turned parallel to two diameters, the front portion being rather more than half the length. The body is secured to the wooden stock (Fig. 7), but the barrel is only clipped to it, and is left perfectly free to expand and contract. It lies in a deep groove in the wood, and is held in place by two perfectly parallel clips which serve only as guides, and do not fetter the movements of the barrel. The bore of the barrel is 7·65 mm. (0·301 in.). The front sight is a barleycorn; it is mounted on a ring which is slipped over the end of the barrel up to a shoulder and is brazed there. The back sight is marked up to 2,050 meters.—*Engineering.*

Truck Farming.

The United States census office has recently issued some highly interesting statistics of truck farming in the United States, as distinguished from market gardening, which is conducted so near to the local market that the farmer depends on his own team for transportation. The average truck farm is situated a great distance from the market in which its produce is disposed of. It is a new feature introduced within the few last years, except the little which used to be possible by canal. It is the modern railroad that has rendered possible the truck farm, and this partly accounts for the fact of its neglect in previous census compilations. Not that there was no truck farming in 1880, but the volume of it was vastly less than now.

It is estimated that upward of $100,000,000 is invested in the industry in the United States, the annual production being three-quarters of this amount, or $76,500,000, realized from 534,440 acres of land. In the work are engaged 216,765 men, 9,264 women and 14,874 children, who are aided by 75,868 horses and mules, and use nearly $9,000,000 worth of agricultural implements. The industry is carried on in nearly all the States, but the principal districts are a narrow belt on the South Atlantic coast and along the Mississippi Valley. The more fertile soils are chosen, labor and the railroad do the rest. The big cities are the best customers of the truck farmer, the wants of the people in the smaller centers of population being to a large extent supplied from the immediate neighborhood, and they take less per capita of that grown in other climates than their own.

The merchants of Chicago draw hither the fruits of Georgia, Florida, the West India Islands and Central America, the peaches and berries of Illinois and Michigan, Indiana, Ohio and Missouri, apples, grapes and pears from California, and cranberries from the marshes of Wisconsin. And the range of their distributive work is almost equally wide.

Few people have a correct idea of the effect this business has on transportation. In the season for most of the fruits special trains run each day from the producing districts to this city, the peaches and strawberries load down the boats which ply regularly between Chicago and the ports on the opposite shore of Lake Michigan, and hundreds of persons are employed here in the work of receiving, besides the thousands who find employment in handling the material at other points while it is being collected and distributed after having been raised by an army of workers. And, as previously stated, all this is of modern origin. The vast increase to human comfort permitted by the enjoyment of the products of other areas than those which surround the consumer, and the concomitant benefit to the many who in this direction minister to the supply of what may be called necessary luxuries to their fellow creatures, is the outgrowth of the present generation, which, by making railroad transportation far-reaching, speedy and cheap, has permitted the interchange of commodities on a scale that would never have been dreamed of by the people of fifty years ago. —*Chicago Tribune.*

The Sinking of the Utopia.

Here we have a Clyde-built steamer of 2,700 tons, long engaged in the Atlantic passenger trade, which leaves Naples for New York with 800 Italian emigrants on board, puts into Gibraltar to fill up with coal from her owner's coal hulk, and while preparing to drop anchor, collides with a warship, and, as a consequence, more than five hundred of those on board are drowned within view of the shore.

It is not our function or purpose to blame anybody for this terrible loss of life, nor do we suggest that, in view of what are the usual conditions under which the ocean passenger trade is conducted, there is any special blame to be attributed to any one in this case. On the contrary, it is to be feared that what happened in Gibraltar Bay on March 17 might have occurred to ninety-nine out of every hundred steamers at present afloat; and that as regards casualty by collision, the safety of passengers on the sea is for the most part to be found in the skill and care of the navigators rather than in the design of the vessels themselves. The shell of the strongest ship is necessarily so thin that contact, when in motion, with anything harder than water must inevitably result in penetration and the admission of the sea. After that the fate of the passenger depends upon the capacity of the compartment into which the water flows. If the compartment is so limited in size that when full of water to the sea level the vessel has still sufficient buoyancy to keep afloat, and if the bulkheads bounding the compartment are sufficiently strong to endure the strain thus brought upon them, then the passengers are safe. Safe for a time, at least, until they can be removed from the damaged ship, and altogether safe if favoring conditions of wind and sea enable her to reach port in her injured condition, as did the City of Paris last year. The worst place in which any steamer's side can be penetrated is abreast her machinery or boilers, as then her propelling power is lost. But if that space is so large as to admit water enough to sink the ship, then the mischief is at a maximum. This was the case with the Utopia, and her fate would be shared by the great majority of her sisters in the mercantile marine if similarly circumstanced.

But should such a fate be a necessary consequence of such an accident to a passenger steamer? The best answer to that question is afforded in the statement that such a fate would not befall certain passenger steamers if injured as was the Utopia. There are many vessels afloat, and several now being built, which, had they been borne down upon the Anson's ram, as was the ill-fated Anchor liner, would now be afloat without the loss of a soul. Why, then, should not all certified passenger steamers be so constructed? Why should any steamer constructed otherwise be certified as fit to carry passengers? We leave these questions to be answered by those who alone are in a position to afford authoritative replies.—*The Engineer.*

The Textile Industries in Maine.

The capital invested in cotton manufactories in Maine is $15,292,078, and capital invested in Maine woolen manufactures $3,876,028, a total of $19,168,106. The cotton mills use 13,586 horse power water and 1,875 horse power steam, a total of 15,461 horse power, and the woolen mills 3,406 horse power water and 404 steam, amounting to 3,810 horse power, the total horse power for cotton and woolen being 19,271. The cotton mills employ 859,890 spindles and 22,698 looms, and the woolen mills 358 sets of cards and 1,577 looms. The product of the cotton mills aggregates 204,282,000 yards per year, equivalent to 116,069 miles of cloth. The value of the annual product is for cotton $13,319,363 and woolen $6,686,073, a total of $20,005,436. The cotton mills pay in wages $2,936,640 and the woolen $1,044,606, a total of $3,981,246. The cotton mills employ 11,759 hands and the woolen mills 3,095, a total of 14,854 hands.

California Tin.

The first ingots of tin ever made in California lately arrived in San Francisco from the mines of the San Jacinto estate, Cajalco, San Bernardino County. These are what were known as the Temescal tin mines, which were discovered many years ago. Litigation and other causes have prevented the claims from being developed, but now an English company has purchased and equipped them for active work. Oil fuel is used in the furnace, this being much cheaper in that region than coal. The experiments with the reverberatory furnace and oil fuel seem to be successful.

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BEAUTIFUL EXAMPLE OF DIFFRACTION.

BY GEO. M. HOPKINS.

Diffraction, as is well known, is the change which light undergoes when passing the edge of a body, or in passing through a narrow slit or aperture in an opaque body. The rays appear to become bent so as to penetrate into the shadow of the body. A common example of this phenomenon is the experiment in which a beam of light is made to pass across the edge of a sharp instrument, a razor for example.

The most beautiful example of diffraction phenomena is given by the gratings used for producing the spectrum. As we have at present nothing to do with the purely scientific application of this phenomenon, we confine ourselves to a single example, as shown in the mineral commonly known as star mica (phlogopite). A thin plate of this mineral placed opposite a point of light, such as a candle flame or a small gas flame, exhibits six radial bands of light emanating from a point opposite the flame, and arranged symmetrically at the angle of 60 deg. These bands rotate with the plate when it is turned in its own plane; often more than six such bands are shown, but the number is always a multiple of six.

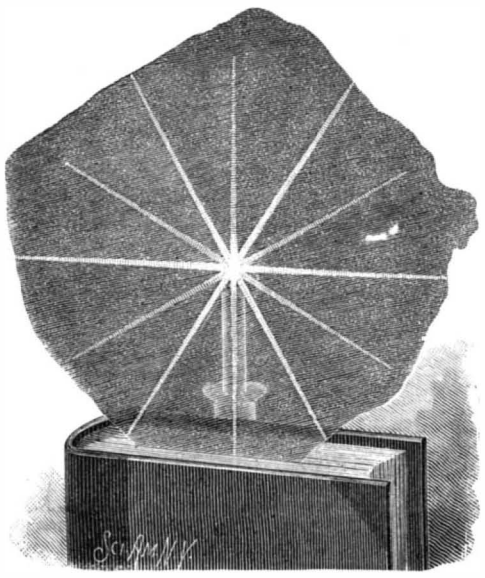

Fig. 1.—STAR MICA.

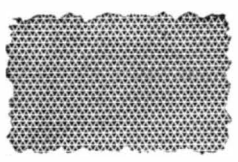

Fig. 2.—LINES SHOWING THE ARRANGEMENT OF CRYSTALS PRODUCING SIX RADIAL BANDS.

In Fig. 1 is shown a star-like figure produced in the manner described, which is really composed of two like figures each having six radial bands, one figure being much stronger than the other. Microscopic examination of the plate shows a multitude of minute, needle-like crystals. The light passing over the edges of these crystals is diffracted or bent, so that the rays which reach the outer edge of the plate, as well as those passing through the central portions, are bent inward in their passage, so that they meet in the eye and produce the phenomenon described. It has been ascertained that these minute crystals are "hemimorphic crystals of rutile elongated in the direction of the vertical axis." This phenomenon was noticed by G. Rose as early as 1862, but the nature of the crystals was ascertained by Lacroix.

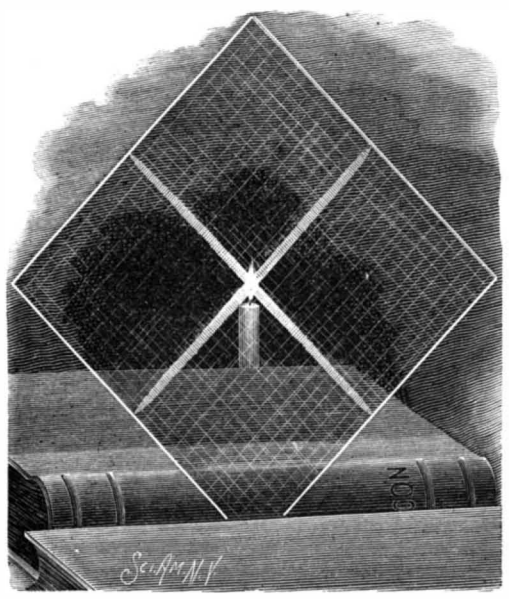

Fig. 3.—GLASS SCRATCHED IN TWO DIRECTIONS. ANGLE OF 90°.

The diffraction phenomenon shown by the star mica may be produced artificially by forming minute scratches in the surface of glass; the diffraction bands are of course at right angles to the lines or scratches by which they are formed, therefore if the plate is scratched in one direction, one band will be produced reaching across the plate at right angles to the scratches; if scratched in two directions, two bands will be produced, as shown in Fig. 3; and Fig. 4 represents a glass plate scratched in four directions, the lines being at the angle of 45°, thus producing eight radial bands when the plate is placed in front of a point of light.

It is obvious that by the proper arrangement of the lines any number of radial bands might be produced. The scratches in the glass are almost imperceptible; they are readily produced by rubbing the glass lengthwise and crosswise by a block covered with fine emery paper, the block being guided by a rule.

A beautiful example of the intergrowth of the fine crystals is shown in Fig. 5; the dark and light bands here represented are formed by these crystals, which curiously enough arrange themselves along lines parallel with the sides of the mica crystals in which they are contained. For this example of crystal the writer is indebted to Mr. S. G. Burn, mining engineer.

Some of the points on the star mica were furnished by Mr. L. P. Gratacap, Assistant Curator of the American Museum of Natural History.

Three Hundred Feet into the Air.

In chimney climbing, as in most things else, says the *Pall Mall Budget*, the old order changes.

Time was when the dexterous flying of kites was the initial step in the ascent of a chimney or a church steeple. In addition to the cord by which it was flown, the kite was furnished with a second cord, which hung down vertically. The manipulators of the kite having, to the best of their judgment, got it directly over the apex of the chimney, both cords were steadily hauled upon, and in that way a thin line of communication was established. To one end of that line a rope was fastened, and this in turn was drawn over the steeple. Then to the rope was attached a light chain with a pulley block and tackle affixed. The block was hauled up to the top, and by means of the pulley and tackle the steeple jack, seated in a "bo'sun's chair," made his perilous ascent. Between this time-honored method and that by which Vauxhall chimney in Liverpool has recently been climbed there is a wide gulf fixed, the difference representing an immeasurable increase both of security and of facility for carrying on what repairing work may have to be done. By a system equally ingenious and simple, a ladder is run up outside the chimney at a uniform distance of 2 feet 6 inches from its face, to which it is pinned at regular intervals of 6 feet by firm iron brackets. The climber, mounting the inner side of the ladder, thus makes his ascent within a kind of skeleton cage. While, therefore, the element of risk is not removed, it is greatly lessened. A false step would precipitate him to the earth, but he is less likely to make it in that the liability to become dazed is greatly diminished by the sense of security afforded. What is to be guarded against in chimney climbing is a failure of nerve, and this end is clearly to be attained in proportion as the conditions of the ascent are rendered to the eye less fearful. Vauxhall chimney—a giant among its neighbors—extends aloft to a height of 310 feet. The elevation of its site above the Old Dock sill is 70 feet. The total height of the chimney, therefore, above that well known datum is 380 feet. Everton Church—the highest point of Liverpool—is 250 feet above the Old Dock sill. The elevation of the Monument in London is only 202 feet. Sightseers privileged to ascend the Vauxhall chimney would have the advantage of an additional 108 feet.

The apparatus has been fixed by Mr. W. J. Whitehead, of Red Rock Street, a man young in years, but of ample experience as a "steeple jack," and in conversation with him some interesting facts concerning chimney and steeple climbing may be gathered. The system he adopts has now been employed on many occasions, and is probably, taken all round, the best yet invented. Each ladder is twelve feet in length, and is furnished with four iron arms for attachment to the wall. The process of fixing is extraordinarily rapid. The whole height of Vauxhall chimney was scaled in something less than six hours, although two separate days were taken for the purpose, inasmuch as after a considerable elevation had been attained the first day, the wind became so strong as to render further work dangerous. The process of fixing is after this fashion: Four iron sockets are driven into the base of the chimney, and to these the first ladder is attached by means of its arms. Mounting the ladder so fixed, the operator places a plank across the upper pair of arms, and thus provides himself with a small platform on which he can stand. He then drives in the sockets for the next ladder, hoists it up, and fits it in its position. This ladder, being in it turn made secure, becomes the base of operations for the next, and so the work is carried to the top, the whole, when completed, being a structure of remarkable rigidity. Its qualities, indeed, in this regard are said to be phenomenal. It is claimed that each ladder of itself is pinned so securely to the wall that in case of need—that is, in the event of tackling an exceptionally high chimney, or of a dearth of plant—the ladders can be successively detached from below, and used to continue the ascent above.

The prime reason for climbing Vauxhall chimney on the present occasion is to repair the lightning conductor. A steeple jack, however, is frequently called upon to perform much more difficult work. Chimneys are frequently increased in height. Huge blocks of stone and iron have to be manipulated. Scaffolds have to be constructed for the purpose, and herein lies perhaps the most risky portion of the undertaking. It is easy to build a scaffold springing from the solid basis of Mother Earth. A vastly different undertaking is it to play topsy-turvy with the laws of gravity, and construct one from the top, downward. The task demands not only nerve, but a knowledge of mechanics and engineering. It is accomplished, however, despite all obstacles, not forgetting the primary one that every batten, plank, and pole employed has to be hauled up to the summit and handled with the most gingerly care. Mr. Whitehead's highest climb hitherto has been a chimney at the Runcorn Soap and Alkali Company's works at Weston, the height of which is 330 feet. Mr. Whitehead confesses to a full sense of the dangers that are run, but is thankful that hitherto his nerve has never failed him, and he has met with no accident.

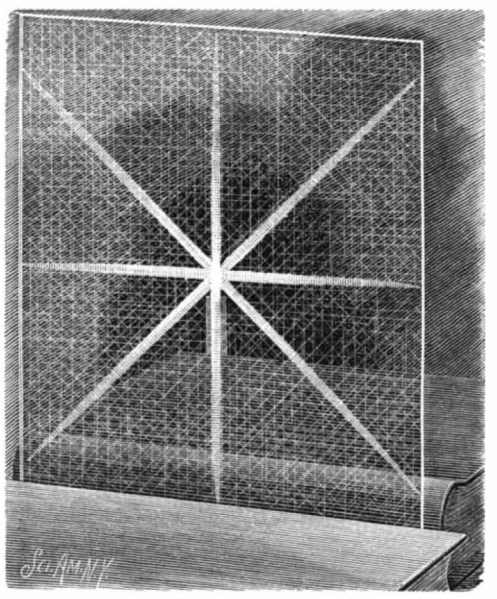

Fig. 4.—GLASS SCRATCHED IN FOUR DIRECTIONS. ANGLE OF 45°.

They are sometimes odd experiences that he has up in the clouds. A high wind, it appears, will cause a tall chimney like Vauxhall not merely to vibrate at the top, but actually to swing over a space of 6 inches or 8 inches, and this without any impairing of its stability. Of course at such times remaining at the top is out of the question. Wind is an invariable danger. A calm day is a *sine qua non* for the work, and meteorologists may perhaps be interested to know that if they suppose the wind at an elevation of 300 feet to be steadier than at the surface level, they are mistaken. It is both more gusty in its character and more variable in its direction.

Sensitive Reaction of Tartaric Acid.

If we throw a few crystals of tartaric acid into a sulphuric solution of full strength containing one per cent of resorcine, and apply heat, there is produced at about 125° a fine violet red coloration which may be preserved indefinitely on dilution with acetic acid, but which is at once destroyed on adding water. In order to detect $\frac{1}{100}$ milligramme of tartaric acid, it is needful to evaporate the liquid to dryness in a small porcelain capsule, to moisten the residue with 1 c. c. of the sulpho-resorcine reagent, and to raise the temperature gradually to 125° to 130°. Reddish stripes appear first at the bottom of the capsule, and the entire liquid becomes colored. The reagent has no action upon succinic, malic, citric, and benzoic acids. The mineral acids do not interfere, except nitric and nitrous acids, which give with resorcine a blue color so intense as to mask the reaction.—*Ed. Mohler.*

Fig. 5.—ARRANGEMENT OF CRYSTALS IN MICA.

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RECENTLY PATENTED INVENTIONS.

Engineering.

ROTARY SNOW PLOW. — John W. Haughawout, Omaha, Neb. This plow is mounted on the front end of a car on which is a motor connected with the main driving shaft, the latter extending through the front end of the car and being turned in either direction by the motor. The wheel on the outer end of the shaft has cone-shaped augers arranged radially, and having their front open ends partly covered by angularly arranged knives, each secured on a radial shaft in the middle of the opening of the auger. The knives are automatically reversed from the main driving shaft, as the motion of the latter is changed to rotate the wheel in either direction, whereby the snow will be cut and delivered to the augers to be discharged by centrifugal force to either side of the track.

CENTRIFUGAL FORCE PUMP.—Edward S. Nicholas and Joseph R. Turner, Greenville, Ohio. This pump is designed to raise light or heavy liquids, and to be used for filling tanks, irrigating lands, for oil pipe lines, water works, etc., being of simple and durable construction and very effective in operation. The casing has a center wall in the shape of an inverted cone, from the apex of which extends downward the suction pipe, an inverted cone-shaped spaced space being formed in which turns an inverted duplex or hollow cone, formed of two spaced concaved disks with a short neck opening into the suction pipe, the hollow cone being rotated within the casing by suitable gears from a power shaft.

METALLIC PISTON PACKING.—Nicholas Pflaum, Port Jervis, N. Y. This invention covers an improvement on a former patented invention of the same inventor. The packing consists of a series of interior blocks having angular exterior surfaces on which are fitted exterior segments, while longitudinally extending keys are fitted into the blocks and segments. The improved construction provided for by the patent is designed to prevent tangential displacement of the segments, displacement in any direction being impossible as long as the packing is in position on the piston.

Railway Appliances.

METALLIC TIE. — Ellison Saunders, Austin, Texas. The base plate of this tie has blocks cast solid therewith at its ends, stay rods or braces connecting the ends with each other, while the blocks form rests for the rails, and have inclined apertures for the reception of ordinary spikes to lock the rails thereto. By this invention no clamp plates are employed, the heads of the rods bearing against the solid outer ends of the rail seats, intergral with the body of the tie.

CATTLE CAR.—Ferdinand E. Canda, New York City. This car is divided into compartments by movable skeleton partitions of bars united by springs, the partitions being operated by endless chains secured to the lower bar, whereby when not in use they may be moved to a position beneath the roof of the car, so that the car may be used to transport cattle in one direction and freight in the other. There is no rigid connection between the bars, which are designed to cant or tilt within the grooves or runs in which the partition is mounted, and prevent the partition from moving too quickly in being lowered to position across the car.

TROLLEY GUIDE FOR ELECTRIC ROADS.—William E. Jackson, Jr., Augusta, Ga. This invention covers novel features of construction and combinations of parts for trolleys used with the overhead system of electric railways. The guide or finder is pivoted to the trolley pole below the wheel, and has curved arms of non-conducting material designed to automatically hold the trolley wheel against the wire, or cause it to come back to place on removal, when, the guide having placed the wheel in position, will automatically drop below the trolley wire, out of the way of overhead supports.

Mechanical.

WARPING MACHINE ATTACHMENT.—Charles Denn, Philadelphia, Pa. This is a cut marker and stop motion mechanism for attachment to any warper, whereby the operator will be prevented from making warps of different lengths or number of cuts by neglecting to cut the warp when the marker rings the alarm. The cut marker is carried by a change wheel shaft on which is a cam adapted for contact with a push bar carrying a propelling device engaging with a cut-defining rack connected with which is a shifting mechanism. The arrangement is such that when the limit is reached of a predetermined length of warp the machine is automatically stopped, and will remain stopped until set in motion again by the operator.

STARCH MACHINE. — John A. Ostenberg, Des Moines, Iowa. This is a continuous automatic machine for manufacturing starch, and has an endless water-tight carrier with supports carrying an endless apron to which the starch mixture is delivered, to be received by a porous apron on another carrier, in combination with a continuous starch table and a series of knives for cutting the starch into lumps. An endless carrier receives and passes the lumps through a crusting oven, and in connection with other carriers are cutters and saws, whereby the starch is fully prepared by one continuous operation, giving a more uniform product and saving time and labor.

TYPE MOULD. — Thomas Mitchell, Brooklyn, N. Y., and John Milne, Long Island City, N. Y. In this mould a base block is cut to afford two sides for a type matrix and two swinging cope bars are formed to afford two other sides to the matrix, with a gate channel between the bars, and two die blocks removably held against the open ends of the matrix. The invention provides a simple and practical mould for producing type with letters or figures on each end.

WIRE FENCE MACHINE. — Hezekiah Miller, Brayton, Iowa. This invention provides a wire spool carrier and winder, consisting of a wheeled truck having shaft bearings at its forward end and handles at its rear end, the spool shaft having a bevel gear on one end, in which meshes a pinion on a shaft extending to a universal joint between the handles of the carrier, where there is a handle, by rotating which the spool shaft is turned. The machine can be readily moved about in winding or unwinding wire, facilitating the setting up or taking down of a fence by one man.

Agricultural.

MOWING MACHINE MECHANISM.—William F. Shuey, Swoope, Va. This is an improved cutting mechanism, wherein the cutter bar is provided with knives passing through guards and arranged in divisions, each having a number of equal sized knives, two adjacent divisions or sections being separated by a knife of a different size from those contained in the division or section. The mechanism is simple and durable, reducing the motive power required, and preventing the choking of the knives, while it is not necessary to back up for a start on heavy grass, as the knives cut alternately.

PORTABLE CORN CRIB. — Charles I. Cook and Henry M. Britton, Odebolt, Iowa. This crib has a cylindrical body formed of spaced slats connected by cables, and with an upper and lower door, with a ventilator of vertical and spaced slats secured together, an air conductor extending from the ventilator to the side of the crib, which has a cover, and an inclined rack opposite the lower door. The invention is an improvement on a former patented invention of the same inventors.

CORN CRIB AND GRANARY. — Charles I. Cook, Albert E. Cook, and Henry M. Britton, Odebolt, Iowa. This is a portable structure designed to be quickly and easily set up or taken down and removed, and adapted to safely hold the various grains. The wall of the crib is formed of flexibly connected slats, mounted on a suitable floor and having braces extending from the top of the wall to the ground and to the floor, with a suitable lining and cover. The floor is made in sections, and the whole may be rolled or folded into small compass, to be easily carried about.

CORN PLANTER. — James Kleihauer, Jr., Elk Creek, Neb. This is designed to be a light draught planter capable of checking without the use of a check line, a marker being provided in connection with the planter which may be conveniently shifted for use at either side of the machine. The frame carrying the drop slide and boxes has a hinged connection with the axle, while a driver's seat is adjustable upon the hinged connection, a rack being connected with the driver's seat, with a lever, whereby the frame may be raised and lowered, and the seat shifted, as desired. The machine is designed to be economically built and durable.

Miscellaneous.

SNAP HOOK. — William T. Morris, Paris, Ark. This is a hook specially adapted to be applied to backbands to hold the traces of plow harness, and consists of a hook depending from a loop, and having its end bent laterally and inwardly toward and under the loop. Upon the inside of the main hook bar is a plate spring, whose free end impinges upon the inner face of the outer limb of the hook.

AN IMPROVED OIL LAMP, patented by Mr. Oliver Sweeney, of New York City, provides an improved means of suspending a lamp. The upper end of the rod attached to the lamp is provided with a spherical head which is received in a concave seat in a stirrup attached to a suspending rod or tube. The reservoir of the lamp is provided with a rod working in the guide thereof, and carrying a valve at its upper end, for controlling the admission of light to the reservoir. This invention is an improvement upon the lamp for which letters patent of the United States were granted to the same inventor on May 18, 1883.

PORTABLE BUILDING.—Mr. Lorenzo D. Jones, Rocky Ford, Ga., has patented a portable building, the parts of which may be quickly assembled to produce a substantial structure without a permanent connection of the several sections comprising it. This invention consists in a novel method of arranging the flooring, side walls and partitions of the house, and in fasteners for securing the parts to each other. The sections of the walls and partitions are connected by latching clamps and corner bracket irons, which are slotted so that they may be readily removed from the studs projecting from the walls. A removable hood for windows and doors is provided, and a porch is attached to the building, which is held in place by fastenings which are easily detached.

AN IMPROVED WASTE AND WATER PIPE VALVE, and connection for wash basins, etc., has been patented by Mr. James R. Whiting, of New York City. This device is intended to prevent the escape of sewer gas into buildings through the waste pipe. In this invention, the waste pipe and water or main supply pipes are provided with gate valves having racks on their stems, and a rock shaft is provided with gears meshing with the racks of the valve stems, the whole being operated by a vertical shaft and gears. The construction is such as to cause the water supply pipe and waste pipe to open and close simultaneously, so that the siphoning of the trap will be avoided, and the escape of sewer gas into the room will be prevented.

BASIN FIXTURE. — Herman Pietsch, Flatbush, N. Y. This invention relates more particularly to stationary wash basins and similar conveniences. The bowl is made with an exterior outlet valve and valve casing constructed to also form an escape for the overflow when the overflow apertures in the bowl are stopped; an overflow trap is also formed in the valve casing, including a removable strainer-like catch box for foreign substrnces passing through the main outlet of the basin.

TACK DRIVER. — Michael G. Mains, Oberlin, Ohio. This is a device for use in laying carpets, and by means of which one may drive the tacks and lay the carpet while standing in an upright position. It also provides means for feeding the tacks so that they will not be spilled upon the carpet, and the separate tacks will not have to be handled. The device has a case with a raceway for the tacks, spring-pressed parallel inclined arms mounted on the lower portion of the case and extending beneath the raceway, while a plunger is held to move in a slideway. The device, in an inclined position, is also adapted for use as a carpet stretcher.

HANDLE AND BRUSH. — Thomas Russell, Fort Douglas, Utah Ter. This is a combination device, the handle being adapted for canes, umbrellas, etc., and the brush suitable for use on clothes and hats and similar articles. The handle is hollow, and has a screw-threaded portion by which it is attached to the cane or other article, while the brush body fits within the central portion of the handle and is held in place by means of screws.

REMEDIAL COSMETIC. — Patrick Rion, Chicago, Ill. This is a composition of milk, ammonia, and other ingredients, for the treatment or toning and freshening of the human skin. It contains nothing deleterious, and does not check or obstruct prespiration.

NUT LOCK. — Aaron C. Vaughan, Shane's Crossing, Ohio. The novel feature of this nut lock consists of a locking washer formed of a metal bar bent into annular form, its ends being provided with recesses, the extremities being beveled and projecting normally in opposite directions from the plane of the body of the washer, whereby the latter is rendered elastic under compression.

VISE.—Charles Wies, Faulkton, South Dakota. This is an attachment for vises to enable tapered bodies to be clamped therein, and consists of two parts, one of which laps at its ends and is detachably secured to one of the jaws of the vise, and the other part is centrally pivoted to the fixed part, so as to rock. The meeting faces of the two parts are beveled from their centers to their ends.

MILK COOLER.—John F. Banks, Bluffton, Texas. This invention consists of a water receptacle adapted to be inserted into a milk bucket or can, about which latter is loosely held a cloth jacket, the upper edge of the jacket being slitted at intervals to form a series of wicks which are dipped into the contents of the water receptacle. The water is carried by capillary attraction exteriorly of the milk receptacle and cools its contents.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

SCIENTIFIC AMERICAN BUILDING EDITION.

APRIL NUMBER.—(No. 66.)

TABLE OF CONTENTS.

1. Plate in colors showing a cottage on Lombard Avenue, Chicago. Two floor plans, perspective elevation, etc. Estimated cost $2,800.
2. Colored plate of an attractive residence erected at Bridgeport, Conn. Cost $6,900 complete. Floor plans and two additional photographic elevations.
3. A cottage costing $2,700 complete, erected for Mr. R. H. Keller, at Rutherford, N. J. Three elevations and plans. Mr. U. D. Peck, architect, Rutherford, N. J.
4. Photographic view and two floor plans of a cottage at Austin, Chicago. Estimated cost $3,300.
5. A row of new dwellings on West 82d Street, New York. Cost of each house $20,000 complete. Messrs. Berg & Clark, New York, architects.
6. Cottage recently erected at New Haven, Conn. Cost $6,850 complete. Floor plans and photographic perspective elevation.
7. An attractive dwelling erected at Yonkers, New York, at a cost of $6,000. Photographic elevation and floor plans.
8. Two photographic views of the beautiful residence of Mr. Noakes, on Riverside Park, New York City, a colored view of which appeared in the March issue.
9. Sketch of a sixteen story office building to be erected at Chicago. Cost $750,000.
10. Sketch of a water-cooled building. One of the novelties proposed and patented for the World's Fair at Chicago.
11. Recently erected English houses. Plans and perspective views.
12. Miscellaneous contents: How to catch contracts.—Toggle bolt for electrical and other fixtures, illustrated.—Composition for retarding the setting of plaster.—Quarrying marble.—The education of customers.—Iron and steel for building purposes.—An improved sanitary earth closet, illustrated.—Stamped metal ceilings, illustrated.—The Plaxton hot water heater, illustrated.—A hot water heater for soft coal, illustrated.—An improved woodworking machine, illustrated.—An improved casing for steam pipes, illustrated.

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Air cooling apparatus for rooms, patented Dec. 3, 1889, No. 416,405. Endorsed by physicians. See illustration in Scientific American, Dec. 28, 1889. Proposals wanted to purchase the patent or to manufacture on royalty. Address L. C. Fouquet, Andale, Kas.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(2983) W. C. H. asks (1) what should be the chemical composition of a wax that is highly conductive of electricity, yet, when exposed to a dynamo current of high intensity, or to atmospheric electricity, such as lightning, that would melt under above named circumstances? A. We can only suggest a mixture of metallic bronze powder or plumbago with paraffin. 2. What is the cheapest and most effective battery motor for experimental work? A. Simple motors are described in our SUPPLEMENT, Nos. 641, 783 and 767.

(2984) Ceylonese asks what sign painters use to stick gold leaf, silver leaf, and tin foil on glass. A. Take as much insinglass as will lie on a quarter dollar; place in a cup, which half fill with boiling water, stir. Fill the cup with alcohol, and strain through a silk handkerchief. Apply to the surface; when sticky attach the leaf or foil. When dry, rub up with cotton, resize, and regild if necessary. When dry, resize three or four times. Paint the backs of the letters with coach black.

(2985) T. J. S. writes: There is a process by which plating with gold is done direct from the anode without the chloride of gold in the solution. How can it be done? A. Use a bath of cyanide of potassium solution. This will dissolve the gold, which will next be deposited on the cathode.

(2986) G. B. asks for a receipt for silvering hollow glass balls. A. Lead and tin, of each 2 ounces, bismuth 2 ounces, mercury 4 ounces. Melt together in order given. Have the globe perfectly clean and dry. Warm it, melt the amalgam and pour it in, and roll it about until the glass is coated. Too high a heat in use will spoil them.

(2987) T. W. H. writes: I have trouble in mixing the articles to make heel ball. Will you inform me as to the proper way? A. The following is a typical formula: Hard suet and beeswax, of each 4 ounces, powdered gum arabic, sugar candy and Venice turpentine, of each 1 ounce, ivory black and lamp black, of each 2 ounces. The solid ingredients must be in finest powder. Melt wax, turpentine and suet together, add the gum arabic, sugar candy and black, and stir thoroughly.

(2988) R. N. A.—A solution of potash or lye is used to soften prints, by means of which, and heavy pressure, they are transferred to boxwood and

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then re-engraved by hand. In order to make a printing block without re-engraving as above, the photo process must be employed.

(2989) C. M. S. asks (1) how the so-called torpedoes which are used on the fourth of July are made. A. By placing a little fulminating powder and a quantity of fine gravel together and wrapping in paper. 2. How to obtain the nickel from a five cent piece? A. Dissolve in nitric acid, expel excess of acid by boiling, precipitate the copper with iron wire, filter, and precipitate the nickel with zinc.

(2990) A. C. asks for the best known method of cleaning fine wall papers and frescoes. A. In many cases they are uncleanable. Bread crumb is about the safest application. Much depends on the nature of the surface. Some walls can be washed with soap and water.

(2991) H. C. R. asks: How to make modeling clay. A. Knead dry clay with glycerine instead of water, work thoroughly with the hands, moisten work at intervals of two or three days, keep covered with an old piece of rubber cloth to prevent evaporation of moisture.

(2992) W. writes: 1. Please give directions for making soda water on a small scale in a chemical laboratory. A. Soda bicarbonate 360 grains, tartaric acid 300 grains. Divide each into twelve parts and wrap in paper separately, one in blue, the other in white paper. In use dissolve separately in two half tumblers of water, mix and drink. 2. What kind of starch is used in the manufacture of baking powder? A. Potato starch is recommended for the purpose. 3. Please explain duplex and quadruplex telegraphy. A. We refer you to our SUPPLEMENT, Nos. 346, 172, 579, 457, 461. 4. Has the Keely motor been entirely given up, as a thing of no value? A. We never believed in it, but cannot answer for others.

(2993) A. C. R. asks: 1. Is there anything that will take the gloss off from clothes and yet not injure the fabric? A. Proper treatment with a hot iron (tailor's goose) will do something, but there is no really effectual treatment. 2. How to make pictures transparent with oil before painting. A. Use castor oil; remove with alcohol when through. 3. Will an induction coil if made long be any stronger than a short one with same quantity of wire? A. No. It will project the lines of force farther out from the core, but will be weaker on the whole than a short one.

(2994) C. E. B. asks: 1. How to dye or stain light-colored leather? A. Take 2 parts iron filings and 1 part bruised gall nuts, boil in 66 parts sharp vinegar. Boil until liquid is reduced about one-half, strain, and apply to the leather. 2. For a paste blacking. A. Mix one part ivory black, ½ part molasses, ⅛ part olive oil, then add ¼ part sulphuric acid and ⅛ part hydrochloric acid.

(2995) L. F. D.—By making a patented article in parts you do not avoid a patent. You cannot use a patented article unless you obtain the consent of the owner of the patent.

Replies to Enquiries.

The following replies relate to enquiries recently published in SCIENTIFIC AMERICAN, and to the number therein given:

(2938) In answer to query 2938, in which C. E. E. asked how to improve the brilliancy of a kerosene light, I would say "use a small jet of nitrous oxide thrown into the flame." There is a young man here using it with gas very successfully for a stereopticon. This gas, as well as oxygen, may be had at the dental depots. J. H. C.

Harvard University, Dental Department.

(2939) Making alkaline water palatable.—In your answer to inquiry of J. B. G., No. 2939, of April 4, in regard to what will make alkali water drinkable, allow me to state that the same power that produced the alkali fields, which causes alkali water, also produced the cactus covering the plains. If J. B. G. will place water in a barrel, tub, or pail, and throw into said water said cactus, he will find it a safe, harmless, and healthy drink, as I know by practical experience in Colorado and Wyoming; or condensed, plenty of cactus in alkali water kills or saves colic.—C. E. BEEBE.

TO INVENTORS.

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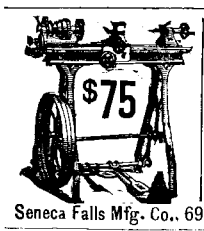

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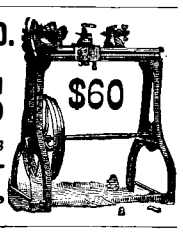

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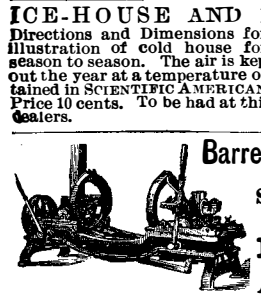

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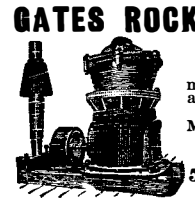

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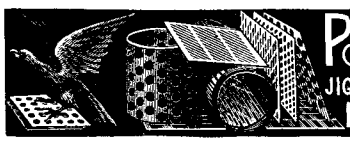

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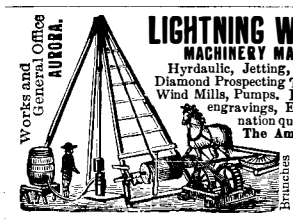

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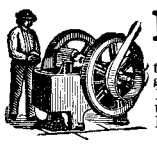

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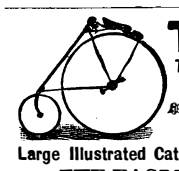

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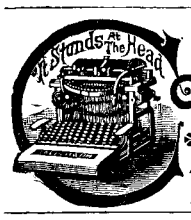

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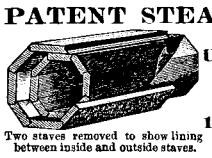

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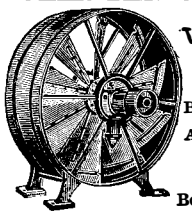

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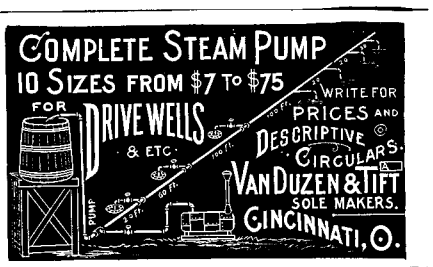
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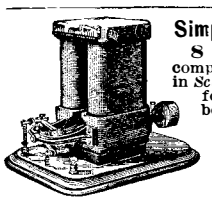

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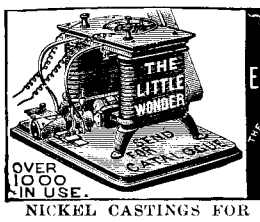

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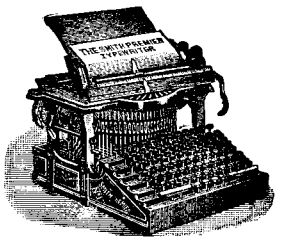

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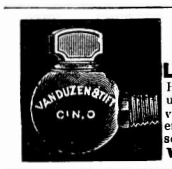

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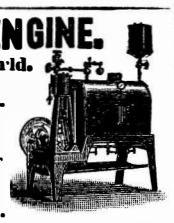

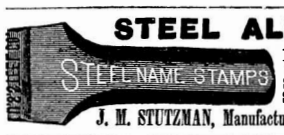

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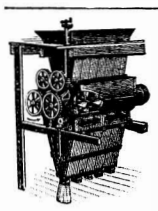

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EX INUTILI TRADE TANITE MARK UTILITAS

WE present herewith to Apprentices, Students, Young Mechanics, and Business Men that Trade Mark which their predecessors saw weekly in these columns almost twenty-five years ago. We call their attention to the fact that this Trade Mark is as closely associated with *a definite method* as it is with definite goods.

SAFE WHEELS,
HIGH SPEED,
SOLID MOUNTINGS,
FREE CUT, and
LIGHT TOUCH,

these are the points for which the *The Tanite Co.* has made a quarter of a century fight. It insists that *conditions of use* are as essential to success as is the *intrinsic quality* of the wheel. To emphasize this idea we now reproduce the cards which *THE TANITE COMPANY* is distributing to all users of its goods.

WITH THE COMPLIMENTS OF
The Tanite Co., of Stroudsburg, Pa.
TO THE
PROPRIETOR.

In the belief that correct ideas and correct practice will insure your more profitable use of grinding impiements and processes, we have taken the liberty of addressing separate and different circular cards to your Grinder, Foreman, Superintendent and Bookkeeper. We ask your own attention to one point only. That is, the great economy which would result from your employing a much larger quantity of simple, low-priced grinding machines, to do that work which is now most wastefully done by the old-fashioned processes of filing and chipping. Now it was demonstrated, in a series of careful experiments, that the maximum cost of grinding off one pound of cast iron was eleven and three-fifths cents, and that the minimun cost was two and four-tenths cents; while the cost of filing off one pound of cast iron was *thirty-five and nine-tenths cents.* Notwithstanding this overwhelming superiority, the proprietor generally puts in one or two grinding machines as a sort of sop to his Superintendent—to the mechanical progress of the times and to the pressing entreaties of the wheel-maker—and stops right there. A professor of mechanics, who visited our grinding room once, looked aghast at the flying sparks and the disappearing metal. He said that shop was "a regular cast iron slaughter house." When we in turn inspected the technical machine shop over which he presided, we found it provided with *bench room and nine vises, but only one grinding machine.*

The zeal of machine builders has led, of late years, to the getting up of a countless variety of complicated special machines, some of which are well calculated to do difficult and exact work, while many have been devised by men of but slight experience in the use of solid wheels, and merely look well on paper. We urge here, as we have persistently done, that *the greatest economy lies in the greatly increased use of wheels and machines for simple, general work.*

WITH THE COMPLIMENTS OF
The Tanite Co., of Stroudsburg, Pa.
TO THE
GRINDER.

It is for your own interest to turn out the very best work possible, and as much of it as you can. The Emery Wheel is your tool—it should be your servant. The more work it does, and the better, why then, it is the better for you. If you use a very hard wheel, then *you have to do* the work with such heavy pressure on the wheel as fatigues you. If you use a soft wheel, then *it does the work*, and your fatigue is less. The less tired you are the more work you can do. The less pressure you are forced to use, the more you can use your hands to guide the metal you are grinding, and thereby you can do better work. Wheels which *cut freely* under light pressure are *the easiest wheels to use.*

If you can keep the metal you are grinding against the wheel *all the time*, it will be the same as if you passed a file one mile long over your work in one minute's time. If your wheel runs below the proper speed, or if it gets out of true, or if it jumps and chatters, then you can't do this; and besides, the jar of the metal and wheel will be tiresome and unpleasant. *The proper speed* is generally the one dictated by the maker and marked on the label. A very cheap speed indicator (to carry in your vest pocket) will tell you if the speed is right. To keep it so, your belts must be looked after and tightened if they stretch or get loose enough to slip. If your grinding machine is of too light weight, or stands unsteadily, a few wooden braces to the floor, wall or ceiling, will stiffen it. If your wheel gets out of true, it should be made true again with a diamond tool; and this ought to be done *just as soon* as you notice the wheel has worn unevenly. You can do this yourself, with a hand tool, without taking the wheel off the machine. All wheels, even the very best, will wear out of true under hand work, and need frequent turning up. Chipping or hacking the high side of a wheel is a rough, brutal, unmechanical remedy, and *no wheel is fit for use* which needs such chipping to make it cut.

WITH THE COMPLIMENTS OF
The Tanite Co., of Stroudsburg, Pa.
TO THE
FOREMAN.

The men under your direction will work with more profit to themselves and their employer if the tools and machines they use are of such kind and in such order that they turn out *the most* goods possible, of *the best quality*, and with *the least danger, fatigue* and *annoyance.* These men will be *on better terms with you* if you make their work easy and profitable. To do easy and profitable work, grinding machines and wheels should be placed *in convenient positions*—belts, pulleys and revolving set screws should be out of the way or enclosed—dust should be removed by suction fans—machines of ample weight should be so mounted that they run with *the least possible shake*, and good Emery Wheels should be used. As all makers claim to make good wheels, and as your Grinders will give you the most confusing opinions, we offer a few ideas as to *what* is a good wheel. A good wheel is that which cuts freely when the metal being ground is applied with moderate pressure—which does not quickly glaze over and clog up with metal—which does throw off chunks or burst—which does not have to be hacked and chipped to make it cut, and which can be applied to the greatest variety of work under varied conditions, with the certainity that it will do fair, average work, with few stoppages for any cause. From 15 to 25 different makes of wheels are offered for sale in the United States. Of these very few are too soft, and nearly all too hard. Very many of these need to be hacked and chipped to make them cut, and require such excessive pressure as to weary your men. Nearly all do their best cutting when first used, but glaze over with metal, and do less and less work the longer they grind. Some are unsafe at the speed of a mile a minute, which has been adapted by the best makers, and a lower speed is named. Any wheel which cannot be run at a speed of a mile a minute without cowls or coverings, or mechanical helps and re-enforcements, is unfit for general use.

WITH THE COMPLIMENTS OF
The Tanite Co., of Stroudsburg, Pa.
TO THE
SUPERINTENDENT.

If solid emery wheels are used in the factory you manage, it is because they are labor-saving and money-making tools. It is of importance that they save *the most labor* and make *the most money.* Ordinary grinders can use them, and ordinary foremen keep them in proper condition; but to attain the greatest economy, sound judgment and technical skill are needed. It is hardly necessary to plead with you for high speeds, free cutting wheels and solid machines. We might as well ask you to run your circular saw by steam and to keep it sharp. But we do need to point out that no ordinary grinder or foreman is likely to make *a correct estimate of a wheel's money value.* There are too many factors in the problem. The actual cost per pound of grinding off metal is the thing to get at. Power, time, pressure and wheel-wear all have to be taken into account. So, too, do incidental stoppages and accidents. Too often wheels are accepted or condemned on superficial and mistaken observation. This is most apt to occur when some different make of wheel is on trial. For instance, nearly all American makes are too hard. Through long use, however, the men become habituated to the poor tool, and compensate for its defects by wearing themselves out with excessive pressure, or wearing the wheel out by hacking and chipping. If one of the free cutting makes is then offered for trial, the grinder applies the same excessive pressure, and wears out the free cutting wheel so fast as to make it appear wasteful. He ought to lessen his pressure, and thereby save both the wheel and himself. At such trials, over-hard wheels are often accepted, because the observation is made during the first few minutes' use of a fresh wheel. Now it is a demonstrated fact that of ten different makes, scientifically tested, *only two* maintained their cutting capacity to the last, while all the rest did their best work in the first few minutes, and then steadily deteriorated.

When we offer you better goods at a reasonably higher price, you meet us with the answer, that "the old wheel suits." So does an old shoe, wrongly shaped and badly made, suit better than a new one, *till the new one is broken in.*

WITH THE COMPLIMENTS OF
The Tanite Co., of Stroudsburg, Pa.
TO THE
BOOK-KEEPER.

As our invoices come under your notice, the comparative prices of our goods are matters of consideration. Please note our views on this subject.

MACHINES. We do not claim to make better or cheaper machines than others, for there are many larger and better machine shops than ours. We claim to make grinding machines as cheap and good as any. Many machines *appear* cheaper than ours, because a lower price is fixed on a machine of same designation and said to have the same capacity. As a rule, such machines are *of lighter wight* than ours, or deficient in fittings or workmanship.

EMERY. Our control of the crude ore is such that, coupled with our improved appliances and processes, we can supply emery at prices *lower* than you can buy it elsewhere. Twenty-three years of experience in the use of this article enable us to assure you as to the quality of these goods.

EMERY WHEELS. Our prices for these goods are about the highest in the world, but their value justifies the price. These wheels are *productive tools* and their value depends on their *productive capacity.* Many other makes are in use, and such use is apparently satisfactory; superintendent, foreman, and sometimes even the grinder working by the piece agreeing that they see no use of changing to higher priced goods. Our answer is that the higher priced goods are *safer* and cause fewer accidents to life, limb and surrounding machinery; that they save time, because *they call for fewer stoppages* for break-downs and repairs; that their *productive capacity is greater*, because they grind off more metal in a given time, and because they *cut more freely*, and so require less pressure and cause *less bodily fatigue* to the grinder.

MISCELLANEOUS GOODS. Our prices on these goods, such as Diamond Tools, Whet Stones, Knife Sharpeners, etc., will be found justly proportioned to their value.

$600 STEAM LAUNCH FREE!
18½ ft. Long. 3 ft. 11 in. Beam. 24 in. Deep.
Send 10c. for New and Complete Catalogue of 1891.

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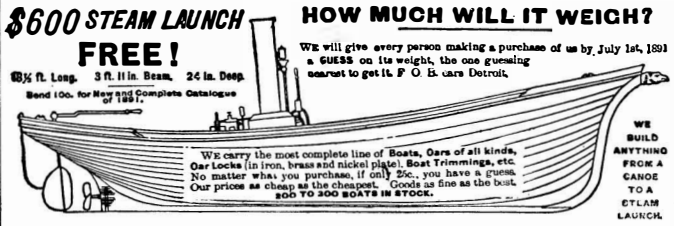
WE will give every person making a purchase of us by July 1st, 1891 a GUESS on its weight, the one guessing nearest to get it, F. O. B. cars Detroit.



We carry the most complete line of Boats, Oars of all kinds, Oar Locks (in iron, brass and nickel plate), Boat Trimmings, etc. No matter what you purchase, if only 25c., you have a guess. Our prices as cheap as the cheapest. Goods as fine as the best. 500 TO 300 BOATS IN STOCK.

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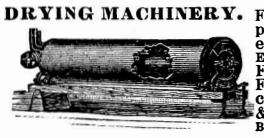

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Branch Office, 35 Murray St., N. Y.

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'90 Crescent Safety, ball bear'gs	$90	$70
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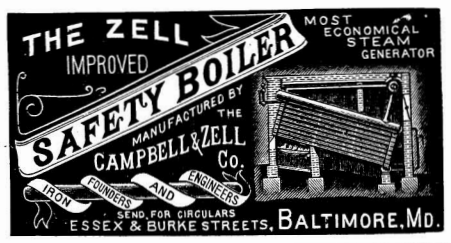


PROPOSALS.

PROPOSALS FOR MAIL-BAG CORD-FASTENERS AND FOR IRON AND STEEL, &c., FOR POST OFFICE DEPARTMENT.

POST OFFICE DEPARTMENT, WASHINGTON, D. C., February 28, 1891.—Sealed proposals will be received at this Department until noon, on Wednesday, the sixth day of May, 1891, for furnishing, according to contract, Mail-bag Cord-fasteners, Iron, Steel, Brass, Oils, and Waste. All proposals must be in accordance with the specifications, which can be obtained from the Second Assistant Postmaster General, Mail Equipment Division.
JOHN WANAMAKER, *Postmaster General.*

BERMUDA.
NOTICE TO ENGINEERS, CONTRACTORS, Etc.

Sealed tenders for deepening the channels leading into Hamilton Harbor, Bermuda, will be received at the Office of the Colonial Secretary, Hamilton, Bermuda, up to 12 o'clock noon of

TUESDAY, THE 14TH OF JULY, 1891.

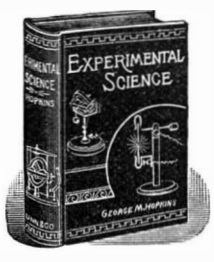
Tenders to be sent in in duplicate, and to be marked on the covers, "Tender for Channel Improvements."

Complete plans of the work may be seen, and specifications, conditions of contract, forms of tender, and printed information regarding the work may be obtained at the office of the Crown Agents for the Colonies, Downing Street, London; at the office of Her Britannic Majesty's Consul General at New York; and at the office of the Colonial Surveyor, Hamilton, Bermuda.

The Government of Bermuda will not be bound to accept the lowest or any other tender.

W. CARDY HALLETT, *Colonial Surveyor.*
HAMILTON, Bermuda, March, 1891.

Experimental Science
BY
Geo. M. Hopkins.



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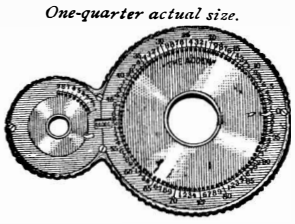

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is achieved by this ingenious little machine, which must be seen to be appreciated. Price, $7. Send for descriptive circular and testimonials to
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Patent No. 446,001, dated February 10, 1891. Fire Escape. The best out. Always ready. Safe, simple, and reliable. Attached to inside of window. Two persons can descend at one time. For particulars, address
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A Wonderful Air Mover. For Drying all kinds of goods (special Dryers built and results guaranteed). Invaluable in Bleacheries, Dye Houses, Hat Shops, Acid and Paint Works, Woolen and Cotton Mills, for removing steam, dust, smoke, hot air, acid fumes, bad odors, and for ventilating Hotels, Laundries, Public Buildings, etc. *High Speed Engine and Fan combined.*

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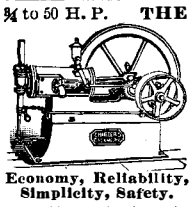

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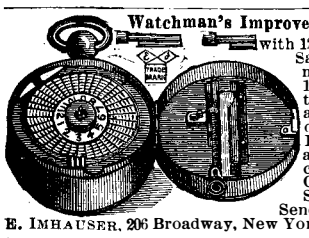

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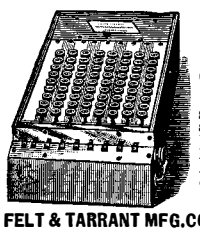

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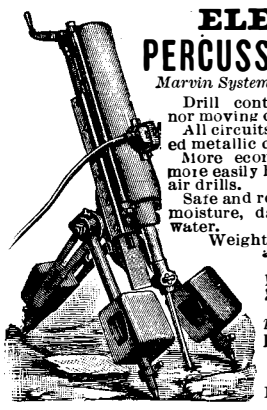

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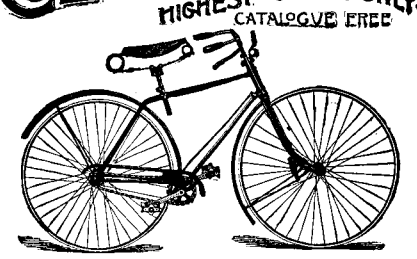

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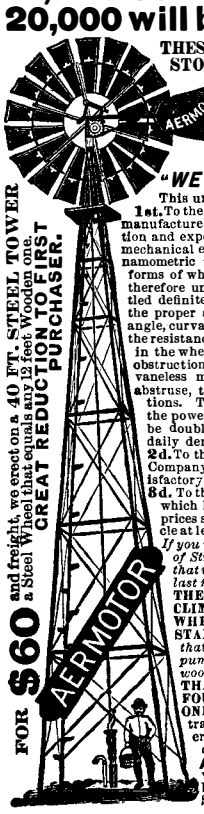
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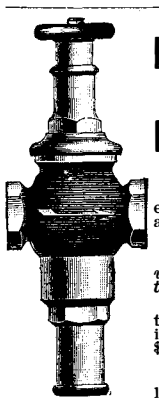

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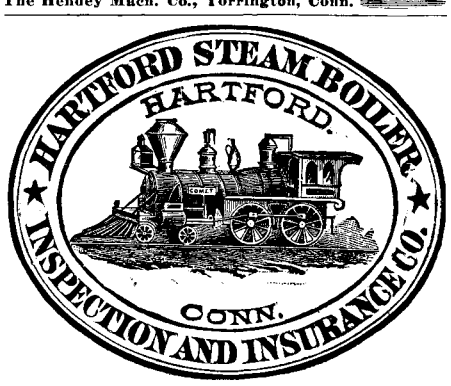

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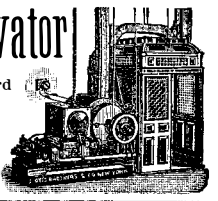

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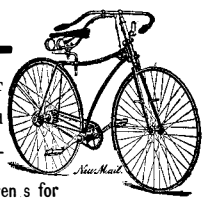

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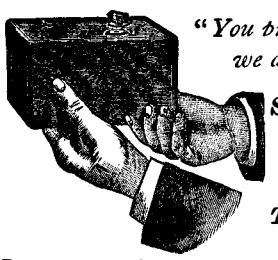

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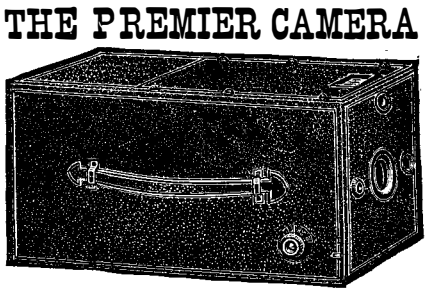

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